Understanding the factors and mechanisms that influence colorectal cancer screening uptake among socially deprived and non-deprived populations.

Anastasia Isavella Tsipa

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Ithaka

As you set out for Ithaka
hope your road is a long one,
full of adventure, full of discovery.
Laistrygonians, Cyclops,
angry Poseidon—don't be afraid of them:
you'll never find things like that on your way
as long as you keep your thoughts raised high,
as long as a rare excitement
stirs your spirit and your body.
Laistrygonians, Cyclops,
wild Poseidon—you won't encounter them
unless you bring them along inside your soul,
unless your soul sets them up in front of you.

Hope your road is a long one.
May there be many summer mornings when,
with what pleasure, what joy,
you enter harbours you're seeing for the first time;
may you stop at Phoenician trading stations
to buy fine things,
mother of pearl and coral, amber and ebony,
sensual perfume of every kind—
as many sensual perfumes as you can;
and may you visit many Egyptian cities
to learn and go on learning from their scholars.

Keep Ithaka always in your mind.
Arriving there is what you're destined for.
But don't hurry the journey at all.
Better if it lasts for years,
so you're old by the time you reach the island,
wealthy with all you've gained on the way,
not expecting Ithaka to make you rich.

Ithaka gave you the marvelous journey.
Without her you wouldn't have set out.
She has nothing left to give you now.

And if you find her poor, Ithaka won't have fooled you. Wise as you will have become, so full of experience, you'll have understood by then what these Ithakas mean.

C. P. Cavafy, "The City" (1984) from *C.P. Cavafy: Collected Poems.*

Ἰθάκη

Σὰ βγεῖς στὸν πηγαιμὸ γιὰ τὴν Ἰθάκη,
νὰ εὔχεσαι νᾆναι μακρὺς ὁ δρόμος,
γεμάτος περιπέτειες, γεμάτος γνώσεις.
Τοὺς Λαιστρυγόνας καὶ τοὺς Κύκλωπας,
τὸν θυμωμένο Ποσειδῶνα μὴ φοβᾶσαι,
τέτοια στὸν δρόμο σου ποτέ σου δὲν θὰ βρεῖς, ἂν μέν᾽ ἡ σκέψις σου ὑψηλή, ἂν ἐκλεκτὴ συγκίνησις τὸ πνεῦμα καὶ τὸ σῶμα σου ἀγγίζει.
Τοὺς Λαιστρυγόνας καὶ τοὺς Κύκλωπας,
τὸν ἄγριο Ποσειδώνα δὲν θὰ συναντήσεις, ἂν δὲν τοὺς κουβανεῖς μὲς στὴν ψυχή σου, ἂν ἡ ψυχή σου δὲν τοὺς στήνει ἐμπρός σου.
Νὰ εὔχεσαι νά ῾ναι μακρὺς ὁ δρόμος.
Πολλὰ τὰ καλοκαιρινὰ πρωϊὰ νὰ εἶναι
ποὺ μὲ τί εὐχαρίστηση, μὲ τί χαρὰ
θὰ μπαίνεις σὲ λιμένας πρωτοειδωμένους·νὰ σταματήσεις σ᾽ ἐμπορεῖα Φοινικικά,
καὶ τὲς καλὲς πραγμάτειες ν᾽ἀποκτήσεις,
σεντέφια καὶ κοράλλια, κεχριμπάρια κ᾽ ἔβενους, καὶ ἡδονικὰ μυρωδικὰ κάθε λογῆς, ὅσο μπορεῖς πιὸ ἄφθονα ἡδονικὰ μυρωδικά. Σὲ πόλεις Αἰγυπτιακὲς πολλὲς νὰ πᾷς, νὰ μάθεις καὶ νὰ μάθεις ἀπ᾽ τοὺς σπουδασμένους.
Πάντα στὸ νοῦ σου νἄχῃς τὴν Ἰθάκη.
Τὸ φθάσιμον ἐκεῖ εἶν᾽ ὁ προορισμός σου.Ἀλλὰ μὴ βιάζῃς τὸ ταξείδι διόλου.
Καλλίτερα χρόνια πολλὰ νὰ διαρκέσει.
Καὶ γέρος πιὰ ν᾽ ἀράξῃς στὸ νησί,
πλούσιος μὲ ὅσα κέρδισες στὸν δρόμο,
μὴ προσδοκώντας πλούτη νὰ σὲ δώσῃ ἡ Ἰθάκη.
Ἡ Ἰθάκη σ᾽ ἔδωσε τ᾽ ὡραῖο ταξίδι.
Χωρὶς αὐτὴν δὲν θἄβγαινες στὸν δρόμο.
Ἄλλα δὲν ἔχει νὰ σὲ δώσει πιά.
Κι ἂν πτωχικὴ τὴν βρῇς, ἡ Ἰθάκη δὲν σὲ γέλασε.
Ἔτσι σοφὸς ποὺ ἔγινες, μὲ τόση πείρα,
ἤδη θὰ τὸ κατάλαβες ἡ Ἰθάκες τί σημαίνουν.

Κ.Π. Καβαφης. Από τα *Ποιήματα 1897-1933*, Ίκαρος 1984)

Abstract

Colorectal cancer (CRC) is the second most common cause of cancer death in the UK. Since the introduction of the NHS Bowel Cancer Screening Programme CRC incidence and mortality rates have reduced, however, screening uptake in the overall population remains suboptimal and is disproportionately low among populations with low socioeconomic status (SES) and Black and Minority Ethnic populations. This thesis aimed to critically assess the available evidence of public health interventions to improve CRC screening and to examine the possible mechanisms of socioeconomic inequalities in CRC screening uptake within a UK setting.

A systematic review and meta-analysis (Study 1) of randomised controlled trials (RCTs) to increase CRC screening uptake was conducted. Data from 102 RCTs including 1.94 million participants were analysed and intervention effectiveness was examined by level of SES. Interventions significantly improved screening uptake, especially among low SES populations, and helped reduce - but not eliminate - SES disparities. Specific intervention strategies were highlighted as effective among low SES groups.

Study 2 used qualitative interviews (N = 27) to explore the views of different socioeconomic and sociodemographic population subgroups and identify the barriers and facilitators to CRC screening. Results highlighted both practical and emotional factors that influenced screening decisions and revealed both similarities and differences in the views of different subgroups. Study 3 used cross-sectional, observational, survey data (N = 206) to explore key sociodemographic and psychosocial variables as potential moderators and mediators of screening intention. Results indicated that psychosocial variables mediated the effects of past behaviour on screening intention and identified some differences by educational attainment and area-level deprivation.

This thesis argues the importance of considering both sociodemographic and psychosocial factors in relation to improving CRC screening uptake and reducing inequalities. Results highlighted key determinants of CRC screening participation and identified specific pathways via which sociodemographic and psychosocial variables interact to affect screening intention. This thesis

provides an evidentiary basis that can be used to inform future public health initiatives and/or interventions that aim to reduce the CRC inequality gap.

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List of Abbreviations

CRC	Colorectal cancer
HDI	Human development index
FAP	Familial adenomatous polyposis
IBD	Inflammatory bowel disease
CRA	Colorectal adenoma
NSAIDs	Non-steroid anti-inflammatory drugs
ICU	Intensive care unit
HRQOL	Health-related quality of life
SES	Socioeconomic status
BAME	Black and Asian minority ethnic
BMI	Body mass index
gFOBT	guaiac faecal occult blood test
RCTs	Randomised controlled trials
SC	Screening colonoscopy
FS	Flexible sigmoidoscopy
FIT	Faecal immunochemical test
NHSBCSP	National health service bowel cancer screening programme
BSS	Bowel scope screening
CCG	Clinical commissioning group
CTC	Computed tomographic colonography
NBCCEDP	National breast and cervical cancer early detection programme
BCTs	Behaviour change techniques
NRSIs	Non-randomised studies of interventions
EMRs	Electronic medical records
TCS	Theory coding scheme
ITT	Intention-to-treat
BCTTv1	Behaviour change technique taxonomy version 1
IBS	Irritable bowel syndrome
IMD	Index of multiple deprivation
MVS	Maximum variation sampling
LSOAs	Lower-layer super output areas
SCMs	Social cognition models
HBM	Health belief model
TPB	Theory of planned behaviour
TRA	Theory of reasoned action
PA	Physical activity
PBC	Perceived behavioural control
TIPI	Ten-item personality inventory
IMPs	Implementation Intentions
HCPs	Healthcare Professionals
LCC	Leeds City Council

Publications and presentations

Publications

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CHAPTER 1

Introduction: Background and Context, Thesis Aims and Objectives

1.1 Chapter summary

This chapter sets out the context of the present thesis firstly, by presenting a summary of the information regarding the global burden of colorectal cancer (CRC), also known as bowel, colon or rectal cancer, as well as its etiology and risk factors. Secondly, this chapter provides a brief outline of the socioeconomic inequalities observed in health overall, but provides a more detailed description of the evidence of inequalities that are specific to CRC. Thirdly, this introductory chapter describes the UK's current cancer strategy implementation plan and the aspects that specifically relate to cancer control through population-based screening, which have been implemented to achieve earlier diagnosis of CRC. Finally, this chapter will conclude by providing the rationale for the three PhD studies included in the thesis and by outlining the thesis aims and objectives.

1.2. Colorectal Cancer: Prevalence and Consequences

Globally, CRC is among the leading causes of mortality and morbidity and represents the third most commonly diagnosed malignancy (following lung and breast cancer) and the fourth leading cause of cancer death worldwide (Torre et al., 2015). CRC accounts for over 9% of all cancer incidence with approximately 1.4 million new cases and near 700,000 deaths occurring in 2012 (Ferlay et al., 2015). The global distribution of CRC burden is not uniform, with almost 60% of new cases occurring in countries with high Human Development Index (HDI) with a Western culture (Janout & Kollárová, 2001).The difference in CRC incidence between countries with the highest and lowest CRC rates can vary up to 10-fold; countries with the highest CRC incidence rates include North America, New Zealand, Australia and several European countries, whereas lower incidence rates are observed in Africa, Central America and South-Central Asia (Boyle & Langman, 2000; Ferlay et al., 2015).

In the UK, CRC is the fourth most commonly diagnosed cancer (following, lung, breast and prostate cancer), with approximately 41,200 people being diagnosed with CRC and 16,000 people dying from CRC annually. Most new cases of CRC occur among older adults with the risk for CRC rising sharply over the age of 55 (Brenner et al., 2007). Approximately 90% of new cases

occur in individuals above the age of 50 and nearly 60% of new cases are diagnosed in people aged 70 or older. Contrary to common belief, nearly 75% of CRC diagnoses occur among average-risk individuals – that is, individuals without a family history or a genetic predisposition to CRC – whereas, approximately 20%-25% of people develop CRC directly as a result from familial history of CRC or adenomatous polyps (Haggar & Boushey, 2009; Valle, 2014).

Several risk factors are associated with CRC incidence. Non-modifiable risk factors of CRC include age, gender and hereditary factors (e.g., family history, genetic predisposition). With regards to hereditary conditions, approximately 5% to 10% of CRC cases result from commonly inherited conditions, that include familial adenomatous polyposis (FAP) and hereditary non-polyposis colorectal cancer (HNPCC), also known as Lynch syndrome (Jackson-Thompson, Ahmed, German, Lai, & Friedman, 2006). Additionally, having a predisposing gastrointestinal illness, such as inflammatory bowel disease (IBD) – a term used to define both ulcerative colitis and Crohn's disease – is also an important risk factor and patients with these conditions present with a 4- to 20-fold increased relative risk for developing CRC (Janout et al., 2001). However, numerous lifestyle and environmental factors play an important role in the development of CRC; for instance, it has been reported that at least 10% of colon cancers in the UK are obesity-related, with visceral, abdominal fat accumulation being highlighted as an important risk factor directly linked to colon carcinogenesis (Ning, Wang, & Giovannucci, 2010; Organization, 2007; Riondino et al., 2014). Other lifestyle factors are also associated with significant increases in the risk for developing CRC, including physical inactivity, high intake of fatty and processed foods, consumption of red and processed meat, high alcohol intake and smoking (Aune et al., 2011; Grosso et al., 2017; WCRF/AICR, 2007). Indeed, CRC is largely considered to be an environmental disease due to its direct link with socio-environmental factors (Brenner, Kloor, & Pox, 2014; Haggar et al., 2009). Some factors have been identified as having a protective effect in that they are associated with a reduced risk for developing CRC; such factors include increased intake of total dietary fibre – indeed, a recent meta-analysis reported an approximately 10% reduced risk of colorectal adenoma (CRA) per 10g/day increase in fibre (Ben et al., 2014) – as well as, chronic use of non-steroidal, anti-inflammatory drugs

(NSAIDs; e.g., aspirin), which appear to reduce CRC risk by preventing inflammation in anatomic subsites within the colorectum. Recent evidence suggests that low-dose daily aspirin use is an effective CRC prevention strategy among individuals with a first-degree relative with a history of CRC (Friis, Riis, Erichsen, Baron, & Sørensen, 2015; Ruder et al., 2011).

The aetiology of CRC remains largely unclear, however, it is widely accepted that there is no single gene that causes CRC, rather the formation of adenomatous polyps is a multistep process, which involves tumour-suppressor and DNA-repair genes being inactivated whilst, concurrently, certain oncogenes (i.e., genes that cause cancer) are being activated, through a series of genetic and epigenetic alterations, referred to as the 'adenoma-carcinoma sequence' (Arnold, Goel, Blum, & Richard Boland, 2005; Leggett & Whitehall, 2010). CRC is characterised by a step-wise progression where normal, healthy cells develop into malignant growths over a time-period estimated to last from five to 15 years (Bogaert & Prenen, 2014; Feng et al., 2015). Depending on the severity of the cancer (i.e., size of cancerous growths, whether the cancer has invaded regional lymph nodes or metastasised), there are four key stages in CRC development; a process also referred to as 'CRC staging'. These stages are: Dukes' A, where the tumour(s) has invaded into the inner lining of the bowel but has not grown *through* the muscle layer of the bowel; Dukes' B, where the tumour(s) has grown through the muscle layer of the bowel; Dukes' C, where the tumour(s) has spread to at least one lymph node close to the bowel; and lastly, Dukes' D, where the cancer has metastasised to other organs of the body (Akkoca et al., 2014).

The degree of cancer symptomatology experienced by patients – for instance, blood in stool, abdominal pain, and constipation - is also directly indicative of the stage of cancer. Patients who are diagnosed with CRC after having experienced subjective symptoms are usually considered to have advanced colorectal tumours compared to asymptomatic CRC patients. Symptomatic CRC patients have more unfavourable intraoperative and short-term, postoperative outcomes, with a recent study reporting less need for Intensive Care Unit (ICU) stay and significantly fewer days of hospitalisation among asymptomatic CRC patients compared to symptomatic CRC patients (Inada et al., 2017). Moreover, the invasiveness and intensity of CRC treatment is largely dictated by the stage of diagnosis; asymptomatic CRC patients

presenting with early-stage CRC have greater chance of undergoing minimally invasive surgery (e.g., polypectomy) compared to patients with advanced CRCs, which require more invasive treatment procedures, including open-surgery/laparoscopic colectomy – a surgical procedure that removes all or part of the colon - which is required to treat the majority of patients presenting with Duke's Stage B and Stage C CRC and is usually combined with chemotherapy to lower the risk of cancer recurrence (Miller et al., 2016)- , and partial hepatectomy, which is usually required in Duke's stage D, which has metastasised to the liver and is performed in combination with chemotherapy and radiotherapy (Butte et al., 2015).

CRC and its treatment are known to have a negative impact on patients' general wellbeing, with a large proportion of patients diagnosed with advanced CRC reporting higher levels of symptoms of depression and anxiety, greater physical functioning impairment, reduced cognitive, emotional and social functioning over time and overall lower ratings of both global and health-related quality of life (HRQOL) that last many years post-diagnosis (Denlinger & Barsevick, 2009; Frazzetto et al., 2012; Mols, Schoormans, de Hingh, Oerlemans, & Husson, 2018; Ramsey, Berry, Moinpour, Giedzinska, & Andersen, 2002; Siegel, Miller, Fedewa, et al., 2017). Apart from the increased burden of disease that patients themselves experience with later-stage CRC diagnosis, treating CRC at a later stage also has implications with regards to medical costs, with evidence suggesting that medical costs are significantly reduced the earlier the stage of diagnosis due to treatment being either less invasive or less intensive than treatment for more advanced CRC (Inada et al., 2017; Lansdorp-Vogelaar, Van Ballegooijen, Zauber, Habbema, & Kuipers, 2009).

Indeed, evidence from health economic evaluations conducted in several countries suggests that the staggering financial impact of CRC is another indicator of the heavy burden of this disease on the health of the population. Apart from the above-mentioned direct costs associated with medical care (e.g., hospitalisation, surgery), CRC and its treatment result in the loss of economic resources as a result of indirect costs as well, which refer to the financial losses associated with the time spent receiving medical care. Indirect costs incorporate morbidity costs – that is, time lost from work and/or loss of ability to participate in other usual activities, including leisure - as well as mortality costs, which

refers to lost productivity due to premature death (Jonas, Russell, Sandler, Chou, & Pignone, 2008; Max et al., 2003; Yabroff, Lund, Kepka, & Mariotto, 2011). These costs are not only incurred by patients themselves, but also their carers and families due to costs associated with the time spent in providing care and/or assistance (Hayman et al., 2001; Van Houtven, Ramsey, Hornbrook, Atienza, & van Ryn, 2010; Yabroff & Kim, 2009) and also employers, due to costs associated with employee disability and increased absenteeism among cancer survivors (Chang et al., 2004).

Moreover, considerable economic costs are associated with long term cancer survivorship, which extends beyond the initial period following a cancer diagnosis or the end of life, and these costs relate to later or lasting effects of treatment or cancer recurrences. For instance, recent evidence suggests that cancer survivors, on average, report greater levels of financial hardship (e.g., medical dept, bankruptcy) as well as increased health-related unemployment and underemployment compared to similar individuals without cancer, even many years post-diagnosis (Banegas et al., 2016; Guy Jr et al., 2013; Yabroff et al., 2016). Currently, the national annual cost for CRC in the USA is estimated between $4.5 billion to $9.6 billion (Yabroff et al., 2009), in Australia $1 billion (Ananda et al., 2016) and in the UK, recent evidence suggests that approximately £542 million are spent annually on CRC-related, hospital care alone (Laudicella, Walsh, Burns, & Smith, 2016). Projections of the costs of future CRC care - based on data for incidence, patterns of care, survival and inflation - suggest that the economic burden of cancer is expected to increase significantly, with these increases being primarily attributed to an aging and growing population, and secondarily to increases in the costs of medical care (Lang et al., 2009; Mariotto, Robin Yabroff, Shao, Feuer, & Brown, 2011). Taken together these findings strongly indicate that CRC is a significant social and public health issue and therefore initiatives that aim to reduce CRC incidence and mortality should be prioritised.

1.3. Inequalities in Health

Within the UK and internationally, there is a clear association between socioeconomic status (SES) and overall health, which shows a consistent pattern of poorer health-related outcomes – including all-cause mortality, reduced life expectancy, disability and higher prevalence of diseases – among people with poorer socioeconomic circumstances (Mackenbach et al., 2008;

Marmot, 2005; Pickett & Wilkinson, 2015; Wilkinson & Marmot, 2003). An improvement in health outcomes has been directly associated with increases in SES – in what is commonly referred to as the socioeconomic gradient in health – with a clear gradient being observed both between and across countries. For instance, the relationship between income inequality and health has been observed in a variety of settings, including rich, developed market economies, such as the UK, USA, Japan, Singapore and Australia (Wilkinson & Pickett, 2007, 2009), as well as developing countries (Babones, 2008). In addition, socioeconomic gradients in health have been reported across states/regions within nations, including Argentina (De Maio, Linetzky, Ferrante, & Fleischer, 2012), China (Pei & Rodriguez, 2006), India (Rajan, Kennedy, & King, 2013), Italy (De Vogli, Mistry, Gnesotto, & Cornia, 2005), Greece (Charonis et al., 2017) and Brazil (Rasella, Aquino, Santos, Paes-Sousa, & Barreto, 2013).

The evidence suggests that the socioeconomic gradient in health is not invariant over time and is influenced by two key processes. Firstly, by social causation – that is, the causal mechanisms of health inequalities resulting from differences in resources, knowledge, support and other factors that are socially stratified. Secondly, by heath selection – that is, the notion that people with good health tend to move upward in the social hierarchy whereas people with less good health tend to move downward -, and the current evidence suggests that both of these processes contribute to socioeconomic disparities in health and their continuation over time (Goldman, 1994; Hoffmann, Kröger, & Geyer, 2018; Kaplan & Keil, 1993; Kröger, Pakpahan, & Hoffmann, 2015; Williams, 1990; Williams, Mohammed, Leavell, & Collins, 2010). For instance, in line with the *social causation* interpretation, a longitudinal study examining socioeconomic health inequalities over a period of 10 years, found that the proportion of participants reporting worse health-related outcomes increased the most among those with greater socioeconomic disadvantage (Elstad & Krokstad, 2003). Similarly, another study reported an inverse association between employment grade and worsening of perceived health over a three-year period (Hemingway, Stafford, Stansfeld, Shipley, & Marmot, 1997). Other studies, have focused predominantly on examining the impact of *health selection* on socioeconomic health inequalities and have shown that ill health has a direct influence on productivity; for instance, unexpected illness necessitates fewer working hours and therefore lower pay, movement to a lower

paying job or even stopping work completely, but at the same time illness may lead to increased levels of absenteeism within the workplace, which in turn can lead to employers favouring employees who are healthy compared to those who are less healthy, both of which can reduce capacity for social mobility and for pursuing opportunities that would provide better and more stable income (Haahr, Frost, & Andersen, 2007; Kröger, 2017).

The fact that the social gradient of health is not fixed - in fact, it varies between countries as well as within regions of the same country and can change over time through processes such as social causation and health selection - implies that there is not a set standard or an absolute metric of socioeconomic inequality that is consistent over time and locality. This in turn suggests that population welfare can fluctuate in response to a range of structural determinants, including age, income, education, occupation, gender, race, ethnicity and place of residence and their interactions with psychosocial determinants of health, including, social support and access to social networks, knowledge, attitudes and beliefs, perceptions of autonomy and control over health (Egan, Tannahill, Petticrew, & Thomas, 2008). The variation of the social gradient in health implies that, in principle, the process by which the magnitude and the steepness of the gradient changes is *dynamic* rather than *static* in nature, thereby offering opportunities for the development of interventions and policies that can target key determinants that are amenable to change, reduce the slope of the gradient and therefore reduce the scale of inequalities.

In recent decades, significant resources have been devoted to uncovering the etiology of socioeconomic disparities in health, however the understanding of these disparities is further complicated due to the confounding of SES and race/ethnicity (Dressler, Oths, & Gravlee, 2005; LaVeist, 2005; Williams et al., 2010). Early approaches to health inequalities research were often limited by conceptualising SES as a binary concept, whereby individuals were either rich – and as a result had better overall health - or poor - and had worse overall health - and failed to consider SES and health on a continuum (Ostrove, Adler, Kuppermann, & Washington, 2001). Moreover, the impact of SES on health was predominantly examined in isolation and the mechanisms by which SES affected health or how the effects of SES might be moderated by a combination of factors, such as education or occupational status, had been largely unexplored. There was also relatively little research on the relationship

between race/ethnicity and SES, with many studies of this earlier era of health inequalities research focusing either on SES or race/ethnicity independently (Adler & Stewart, 2010). However, in recent years the health inequalities literature has evolved and renewed attention has been placed on understanding the possible causal mechanisms, mediators and confounders between socioeconomic inequality and health, with a large proportion of the literature predominantly focusing on understanding the complex interrelationship between SES, race/ethnicity and health (Chen, Martin, & Matthews, 2006; Do, Frank, & Finch, 2012; Kawachi, Daniels, & Robinson, 2005; Subramanian, Chen, Rehkopf, Waterman, & Krieger, 2005; Williams et al., 2010).

Racial and ethnic disparities in health have been well-documented, and it is now widely accepted that SES is a key driver of this relationship (El-Sayed, Finkton Jr, Paczkowski, Keyes, & Galea, 2015; Karlsen & Nazroo, 2002; Navarro, 1990; Schroeder, 2016; Sheldon & Parker, 1992; Smith et al., 1998). In the USA, research findings consistently show that race and SES are correlated (e.g., African Americans are overrepresented among lower SES groups) and national data suggests that there has been relatively little change over time (Williams et al., 2010). An examination of the levels of overall poverty by race from 1980 to 2006 showed that Black and Hispanic ethnic groups had two to three times higher overall poverty compared to White ethnic groups (DeNavas-Walt, 2010). Similarly, in the UK ethnic inequalities in health among Black and Asian Minority Ethnic (BAME) populations have shown to reflect, in part, inequalities in socioeconomic position and social class, health service access and use and racial discrimination (Nazroo, 1997, 2003). For example, national UK data suggests that unemployment rates among BAME populations are higher than White British populations, and particularly high among Black/Black British ethnic groups (Department of Work and Pensions, 2016) and the proportion of low-income BAME households is higher compared to low-income White British households (Kenway & Palmer, 2007). UK data also suggest that socioeconomic inequalities are fundamental cause of ethnic inequalities in health and there are direct associations between ethnic minority status and ill health on the one hand and socioeconomic disadvantage on the other (Bartley, Sacker, & Clarke, 2004; Emerson & Hatton, 2007).

Nonetheless, several studies (Crimmins, Kim, Alley, Karlamangla, & Seeman, 2007; Franks, Muennig, Lubetkin, & Jia, 2006; Williams et al., 2010)

have reported that racial/ethnic disparities between BAME populations and White Caucasian populations remain even after adjusting for SES differences. For example, a study using USA national data from the Health Interview Study linked to the National Death Index found that there were large Black-White hazard ratios across all age groups (i.e., from ages 18 to 75 years), and that these differences in mortality remained significantly higher among the Black Ethnic groups even after adjusting for SES (Franks et al., 2006). Similarly, another study examined variation in scores on chronic disease factors – including indicators of blood pressure, inflammation and metabolic risk – and found that even after adjustment for income, education, gender, age and health behaviours (including smoking, poor diet, physical activity, and access to care), Black populations maintained a higher risk profile on blood pressure, inflammation and total risk compared to White populations (Crimmins et al., 2007). A similar pattern of findings is evident in the UK as well; for example, evidence of the elevated disease risk for ethnic minority populations after SES is considered comes from national UK data that compared all-cause mortality for selected immigrant populations against the national average over the period of 1970 to 1992 and found that mortality ratios for stroke and hypertension were significantly higher among Black immigrant populations (Wild & McKeigue, 1997).

Evidence for the notion that ethnicity affects health independently from SES comes from studies that have examined racial differences in relation to health among middle- and high- income groups. For instance, a handful of studies have shown that Black women and men in high status jobs are significantly more likely to report worse mental and physical health outcomes compared to their White counterparts. This has been attributed partly to occupational tokenism – which occurs when an individual stands apart because of their physical characteristics – as well as discrimination due to minority status within competitive majority spaces (Braboy Jackson & Saunders, 2006; James et al., 2006; Sellers & Neighbors, 2008). Thomas and colleagues (1997) compared a cohort of White physicians from John's Hopkins University with a cohort of Black physicians from Meharry Medical College and found that the Black physicians were significantly more likely to have a greater body mass index (BMI), higher systolic blood pressure, higher risk for cardiovascular disease (CVD), higher incidence of coronary artery disease and higher all-

cause mortality. A more recent study examined race and ethnic disparities among high-income populations (i.e., reported income of $175,000 or above per year) and found that Black ethnic groups were the most disadvantaged compared to other ethnic groups. Namely, Black populations experienced greater risk in terms of diabetes, hypertension and obesity and reported worse overall health, reduced physical activity and fewer routine medical visits relative to White populations, therefore concluding that the health profiles of Black populations were significantly worse despite having an equally high income status as White populations and that health disparities exist even among the highest income groups (Wilson, Thorpe Jr, & LaVeist, 2017). Collectively, these findings suggest that income alone cannot fully explain racial/ethnic inequalities in health and that ethnic/racial minority status is an independent predictor of health.

1.4. Inequalities in CRC

Inequalities in incidence and outcome have been reported for a variety of cancer types (Coleman, Babb, Sloggett, Quinn, & De Stavola, 2001; Dalton et al., 2008; Weiderpass & Pukkala, 2006). Similar to other cancers and diseases, the impact of CRC is not uniform and it is well-documented that the public health burden of CRC varies both by level of SES (Faggiano, Partanen, Kogevinas, & Boffetta, 1997) and by race/ethnicity (Espey et al., 2007; Trivers, Shaw, Sabatino, Shapiro, & Coates, 2008; Wong, Ettner, Boscardin, & Shapiro, 2009). Greater socioeconomic deprivation is associated with a significantly higher CRC incidence rate; for instance, a systematic review examined the association between SES and CRC incidence, treatment, survival and mortality and found that significantly higher CRC incidence was observed among low SES groups compared to high SES groups. Additionally, CRC treatment, survival and mortality all showed less favourable results for people with lower SES (Aarts, Lemmens, Louwman, Kunst, & Coebergh, 2010). Similarly, a recent, prospective study conducted in the US examined whether neighbourhood SES and education, which is considered an SES *proxy*, were associated with greater CRC risk among a sample of 1.5 million participants, and found CRC incidence to be higher among people with lower educational attainment and those who lived in socioeconomically deprived neighbourhoods compared to individuals who were more educated and had higher SES. These education- CRC incidence and SES-CRC incidence associations were evident

even after accounting for non-modifiable risk factors, including age, race/ethnicity and familial CRC history, as well as lifestyle factors including obesity, physical activity and smoking (Doubeni et al., 2012).

The factors that might generate the large racial and socioeconomic disparities in CRC death are several, including less access to curative treatment, greater risk of receiving poorer quality care, diet that may be more conducive to CRC development, higher obesity rates, lower physical activity, greater tobacco and alcohol use and greater medical mistrust (Albano et al., 2007; Dalton et al., 2008; Lumpkins et al., 2013; Lyratzopoulos, Sheridan, Michie, McElduff, & Hobbiss, 2004; Woods, Rachet, & Coleman, 2005). However, one of the main factors contributing to the observed inequalities is that CRC screening uptake is disproportionately low among more socioeconomically vulnerable and BAME populations. Inequalities in CRC screening uptake by income level and race/ethnicity have been shown in several countries, including countries with and without universal health care (Javanparast et al., 2010; Lo, Halloran, et al., 2014; Wardle, McCaffery, Nadel, & Atkin, 2004; Whitaker et al., 2011).

The mechanisms that sustain CRC screening inequalities are several; apart from objective SES factors that undoubtedly influence screening uptake (e.g., income, education, employment), there are also health-related and psychosocial factors that can impede screening uptake among more deprived populations. For instance, empirical evidence suggests that limited health literacy, which pertains to an individual's capacity to obtain, process and understand health information and access health services as needed in order to make informed decisions about one's health, is one of the pathways that can explain nonparticipation in CRC screening among low SES and BAME populations (Gimeno Garcia, 2012; Kobayashi, Wardle, & von Wagner, 2014; Power, Miles, Von Wagner, Robb, & Wardle, 2009). Psychosocial and attitudinal determinants have also been proposed to underlie the observed screening inequalities; studies report that low SES and BAME populations are more likely to experience both emotional and practical barriers in relation to screening, including negative beliefs towards screening procedures, fatalistic beliefs about cancer, lack of recognition with regards to the benefits of screening uptake and lower perceived self-efficacy with regards to screening procedures (James et al., 2006; Power et al., 2009; Schroy et al., 2008; Von Wagner, Semmler, Good,

& Wardle, 2009). More recently, researchers have aimed to develop a conceptual framework for investigating inequalities in cancer screening by investigating the complex links between SES and associated aspects of life experiences (Von Wagner, Baio, et al., 2011). For instance, it is known that individuals with lower incomes experience adverse life events more frequently than high-income populations, have fewer socioeconomic resources in order to cope with stressful events and, as a result, have less time available to engage with preventative health behaviours such as screening (Hatch & Dohrenwend, 2007; Marmot et al., 2008).

In the UK there have been a number of studies examining stool-based CRC screening uptake – using the guaiac Faecal Occult Blood Test (gFOBT) - in relation to area-level socioeconomic deprivation; for instance a study by von Wagner and colleagues (2009) examined gFOBT uptake rates over the first 30 months of the national screening programme in London in a sample of over 400,000 participants. The authors concluded that a strong socio-economic gradient exists in gFOBT uptake (49% and 32% uptake in the least and most deprived quintile of postcodes respectively). Von Wagner et al (2011) later conducted a follow-up analysis to include UK-wide data in order to improve generalisability of findings, and analysed data from 2.6 million participants that were invited to take part in gFOBT screening between October 2006 and January 2009. A similar pattern of findings was observed, where a clear socioeconomic gradient in uptake was highlighted again. Moreover, uptake rates ranged from 35% to 61% in the most and least deprived areas of England. Results further indicated that the most ethnically diverse areas also had lower uptake (38%) than other areas (52%-58%), a finding which was independent of SES, age, gender and region, suggesting that ethnicity uniquely contributes to the observed screening disparities.

Indeed, a number of international and national studies have highlighted ethnic inequalities in CRC screening. Evidence from the US shows that CRC screening uptake is substantially lower among African American populations; a disparities trend consistently observed in the USA since 1980 (Boring & Squires; Breen, Lewis, Gibson, Yu, & Harper, 2017; Weinrich, 1990) as well as in immigrant Asian populations including Korean, Chinese, Japanese and South-East Asian immigrants (Kim, Yu, Chen, Kim, & Brintnall, 1998; Lee et al., 2012; Tang, Solomon, & McCracken, 2001; Wong, Gildengorin, Nguyen, &

Mock, 2005). A UK-based study (Szczepura, Price, & Gumber, 2008) analysed gFOBT uptake patterns among a sample of 123,367 participants to compare uptake rates between South Asian and non-Asian UK populations, as well as between five Asian subgroups (including Hindu-Gujarati, Hindu-Other, Muslim, Sikh and South Asian Other), and found that uptake rates were significantly lower among South Asian populations compared to non-Asian populations (32.8% and 61.3% uptake respectively) and that rates were particularly low for the Muslim subgroup (26.1% and 21.5% for the first and second screening rounds respectively).

CRC inequalities in uptake also widen inequalities in stage of cancer diagnosis and cancer survival (Frederiksen, Osler, Harling, & Jørgensen, 2008; Mitry, Rachet, Quinn, Cooper, & Coleman, 2008). In a recent report, Siegel and colleagues (2017) analysed the latest US-based data on CRC incidence, survival, mortality rates and trends by gender, age group, anatomic subsite, race/ethnicity and geographic area. Results indicated that incidence rates in non-Hispanic Black populations were approximately 20% higher than the rates of non-Hispanic White populations, and the magnitude of the disparity for mortality was double that for incidence – that is, mortality rates were approximately 40% higher among non-Hispanic Blacks compared to non-Hispanic Whites. The authors reported that differences in screening uptake were estimated to account for 40% of the racial disparity in CRC mortality between Black and White ethnic groups.

This finding is consistent with the results from a microsimulation study conducted by Lansdorp-Vogelaar and colleagues (2012), which estimated how much of these racial disparities in CRC incidence and mortality could be explained by differences in CRC screening uptake. Results indicated that screening uptake explained more than 40% of the existing racial disparity in CRC incidence and 20% of the disparity in CRC mortality, between Black and White ethnic groups. Similarly, Valeri and colleagues (2016) quantified the extent to which survival disparities would be reduced, had Black-White disparities in stage of diagnosis been eliminated. Results showed that the elimination of disparities in stage of diagnosis would contribute to a reduction of approximately 35% in survival disparities. These findings imply that reductions in screening disparities could in turn lead to substantially fewer disparities observed at stage of diagnosis, which consequently would also reduce racial

disparities in survival. The importance of CRC screening in cancer control, an overview of the screening modalities currently utilised and a description of the UK's national bowel cancer screening programme are described below.

1.5. The Importance of Colorectal Cancer Screening

CRC screening is a well-established component of secondary preventive medical care in high-income countries (Altobelli, Lattanzi, Paduano, Varassi, & Di Orio, 2014; Burt et al., 2010; Gupta et al., 2013; Schreuders et al., 2015). The purpose of screening is to reduce CRC incidence and mortality and increase detection of early-stage CRC when cancer is highly treatable. The capacity of CRC screening to reduce CRC incidence and mortality has prompted the introduction of population-based, mass screening programmes over the past decades mostly in developed countries including the USA, European countries – including the UK, Netherlands, Denmark, Sweden, Finland, Austria, France, Germany, Italy, Spain, Poland and the Czech Republic – and non-European countries – including Israel, Japan, Korea, Australia and Uruguay (Benson et al., 2008; Gutiérrez-Ibarluzea, Asua, & Latorre, 2008).

The implementation of such programmes has led to significantly more favourable disease prognosis, has improved overall patient outcomes and has already had a measurable impact on disease burden on a global scale (Gellad & Provenzale, 2010). Results from several randomised controlled trials (RCTs) have shown that CRC screening is associated with significant reduction in CRC incidence and/or mortality (Atkin et al., 2010; Hardcastle et al., 1996; Kronborg, Fenger, Olsen, Jørgensen, & Søndergaard, 1996; Lindholm, Brevinge, & Haglind, 2008; Schoen et al., 2012). According to Cancer Research UK statistics (2014), stool-based screening – and particularly gFOBT screening - is expected to save 2,000 lives each year in the UK by 2025. Reinforcing this notion, a systematic review including data from a sample of 320,000 participants, with follow-up ranging from 8 to 18 years (Hewitson, Ward, Heneghan, Halloran, & Mant, 2011), found that gFOBT screening achieved a reduction in the relative risk of CRC mortality by 16%. Other CRC screening modalities, including screening colonoscopy (SC) and flexible sigmoidoscopy (FS), have achieved similar reductions in CRC mortality (Zauber et al., 2008). Moreover, early diagnosis combined with early intervention and treatment are estimated to achieve population-wide reductions in CRC incidence by as much as 33% and CRC mortality by as much as 43% (Atkin et al., 2010).

Unlike other cancers, early stages of CRC are identifiable and often treatable. According to national statistics, five-year, overall survival rates are 85-95% when CRC is detected during Duke's stage A, whereas survival rates gradually decline to 60-80%, 30-60% and to <10% for Duke's stages B, C and D respectively (National Cancer Intelligence Network, 2009). Collectively, these statistics suggest that CRC is largely treatable when diagnosed at the earliest stage possible and in the UK the NHS Five Year Forward View (National Cancer Transformation Board, 2016) report has identified earlier diagnosis of cancer through screening as a key strategic priority for achieving the best cancer outcomes in England by 2020.

1.6. Overview of Screening Modalities

1.6.1. Non-endoscopic Screening Modalities: Faecal and Serum Tests

i) Guaiac Faecal Occult Blood Test (gFOBT)

The gFOBT is the least invasive CRC screening method and operates by detecting the presence or absence of blood in stool. A positive test is noted when occult blood is found in the stool sample, which may indicate the presence of CRC or polyps in the colon or rectum. Despite its ease of use, accurate screening with gFOBT can be difficult and screening results are known to be affected by dietary changes. Moreover, the gFOBT requires samples to be collected multiple times (two samples from three consecutive bowel movements) on multiple occasions (biennially in most countries), with multiple sampling increasing the risk of false-positive results and in turn increasing medical costs from further diagnostic workup (Dressler et al., 2005; Vilkin et al., 2005).

ii) Faecal Immunochemical Stool Tests (FIT)

The FIT is based on principles similar to those of the gFOBT, however the specificity of the FIT is increased due to its ability to detect human hemoglobin, hence removing any need for dietary restrictions that apply to gFOBT and thus reducing the risk of false-positive results. Currently, there are no RCTs evaluating the benefits of the FIT in relation to CRC incidence and mortality. However, numerous RCTs have compared the gFOBT to the FIT with regards to their diagnostic specificity and sensitivity and have reported, that in comparison to the gFOBT, the FIT exhibits greater diagnostic performance, improved sensitivity and increased detection rates of advanced cancerous neoplasms (Faivre et al., 2012; Levi et al., 2011). Preliminary evidence also

suggests that an additional benefit of the FIT is that it has potential to improve compliance rates due to greater ease of completion, given that the FIT requires a single stool sample to be collected, as well as the lack of dietary restrictions (Chambers, Callander, Grangeret, & O'Carroll, 2016; Goede et al., 2017).

1.6.2. Endoscopic Screening Modalities: Screening Colonoscopy and Flexible Sigmoidoscopy

i) Screening Colonoscopy (SC)

SC is considered an optical screening procedure, during which the entire colon and rectum are visually examined to detect polyps or cancer. The major advantage of SC is that it allows for the direct visualisation of the entire colon and any polyps discovered during the procedure can be readily removed by polypectomy. SC is the only modality that offers a one-step approach to CRC screening and patients with abnormal test results from stool-based screening modalities are required to undergo a follow-up SC. An important advantage of SC is the extended recommended interval between testing which is 10 years, which has been associated with improved patient compliance (Lee et al., 2012). There are several disadvantages associated with SC including the invasiveness of the procedure and the inherent risks that are associated with it, the time and discomfort experienced by patients during bowel preparation, and increased medical costs. Despite these disadvantages, SC is considered the 'gold standard' for the detection of CRC and adenomatous polyps and the available epidemiological evidence suggests that SC is effective in reducing CRC incidence and mortality.

ii) Flexible Sigmoidoscopy (FS)

In contrast to SC, FS only inspects the left side of the colon for neoplasia. Its usage is usually in a two-stage model, with FS used in conjunction with SC for initial FS-positive patients. It is a safe and quick process which can be performed without sedation, thereby negating the need for hospital admission. FS is associated also with greater patient acceptability due to the fewer preparations required in comparison to SC. The main disadvantage of FS as a screening tool is that empirical evidence shows that approximately 50% of colonic neoplasia will be missed. Nevertheless, meta-analyses suggest that the efficacy of FS in reducing CRC mortality has been proven in several

case-controlled and cohort studies (Elmunzer et al., 2012; Shroff, Thosani, Batra, Singh, & Guha, 2014).

1.7. NHS Bowel Cancer Screening Programme

The UK is among the many countries that have implemented population-based, national CRC screening programmes, which aim to look for early signs of cancer in people who are not currently experiencing any cancer symptomatology (i.e., are asymptomatic). The UK National Health Service Bowel Cancer Screening Programme (NHSBCSP) was officially introduced in England in 2006, following two pilot programmes. Prior to the introduction of the programme, CRC screening had operated on an ad-hoc basis. There are two aspects of the NHSBCSP – the programme predominantly uses the gFOBT, and more recently, the complementary English Bowel Scope Screening (BSS) programme has been introduced, which uses the FS. In the UK, eligible individuals are automatically sent self-administered bowel cancer screening kits (i.e., home-based gFOBT testing) every two years. To be eligible for gFOBT screening, people are required to be registered with a general practitioner (GP) and to be aged between 60 and 74 years. gFOBT screening kits are distributed nationally via five regional screening hubs across England. The main aim of the NHSBCSP is to detect CRC at an early stage when treatment is more likely to be effective and survival rates are likely to be higher. In June 2016 Public Health England announced the replacement of the gFOBT with the FIT, which is anticipated to improve uptake, especially among populations with low SES and BAME ethnic groups (Moss, Mathews, Day, Smith, & Halloran, 2015). Based on the recent NHS Five Year Forward View the government's goal at present is to achieve 75% uptake of the FIT in all CCGs by 2020.

The government's target for 75% uptake of the FIT is particularly ambitious, given that CRC screening has been an ongoing public health challenge in England. Both pilots of the English Bowel Cancer Screening programmes (implemented in 2000 and 2006) found that only 52.1% and 52% of those that had been sent a gFOBT screening kit had returned it, for the first and second pilot respectively, not managing to meet the government's target for 60% gFOBT uptake (UK Colorectal Cancer Screening Pilot Group, 2004; Weller et al., 2007a). Particularly challenging has been the engagement of low SES and BAME populations with gFOBT screening – as mentioned previously, inequalities in CRC screening is a recurrent theme within the literature – with

significant reductions in gFOBT uptake being observed with increasing level of deprivation (Weller et al., 2007a). In addition, results from the two pilots showed that gFOBT uptake was particularly low in men compared to women, and screening among both genders further decreased with increasing level of deprivation (Weller et al., 2007a). More recently Logan and colleagues (2012) analysed data from 2.1 million participants that were invited during the first round of the English bowel cancer screening programme (rolled out between June 2006 and October 2008) and found that uptake was generally lower in areas with greater deprivation. Notably, in certain London areas, gFOBT uptake was critically low, marginally reaching 40% uptake rate, with the authors partly attributing lower screening rates to the greater ethnic mix and larger immigrant population in London compared to the rest of England (Logan et al., 2012). The figures for gFOBT screening rates are also substantially lower compared to uptake rates achieved by other national, population-based screening programmes, with recent UK data showing a 75.1% uptake for breast cancer screening and a 73.5% uptake for cervical screening in comparison to 58.2% uptake for CRC screening (Public Health England, 2015).

Similarly low CRC screening uptake rates are observed in the city of Leeds, West Yorkshire. Based on regional data, screening adherence in Leeds ranges from 52.1% in the Leeds South and East Clinical Commissioning Groups (CCG), to 56.08% in Leeds North CCG. Substantial variability in uptake exists by postcode ranging from as high as 69.2% in more affluent areas (North Leeds) to as low as 25.9% in more deprived, inner-city areas (South and East Leeds). Screening uptake is lowest in the South and East CCG. Moreover, the South-East Leeds CCG was ranked as the most socioeconomically deprived among the three Leeds CCGs according to the Public Health England report on Indices of Deprivation at CCG level (Smith et al., 2015).

1.8. Thesis Aims

This chapter has showcased the importance of CRC screening and has outlined the available evidence, which strongly suggests that earlier diagnosis of CRC via screening can be transformative in terms of improving survival, reducing mortality and improving quality of life. This chapter also provided an overview of the socioeconomic and racial/ethnic inequalities in both CRC incidence, mortality and survival, which are partly explained by disparities in CRC screening participation. Given that the NHSBCSP in the UK provides the

means via which early detection of CRC can be achieved, it is crucial to further understand what strategies might be effective in increasing CRC screening compliance across the entire population, but also among low SES and BAME populations in particular. In doing so, it is anticipated that this will inform and extend the current evidence base and will contribute to the development of more efficient strategies to firstly, improve overall CRC uptake and secondly, to improve the equitable distribution of CRC screening services.

Therefore the present thesis aimed:

1. To evaluate the effectiveness of existing interventions to improve CRC screening uptake and to examine whether effectiveness varies by level of SES (Study 1).
2. To identify the barriers and facilitators to gFOBT uptake among different population subgroups (Study 2).
3. To explore acceptability of the FIT screening kit (Study 2)
4. To assess the direct and indirect pathways via which sociodemographic and psychosocial factors influence gFOBT screening intention (Study 3).

CHAPTER 2

Systematic Review and Meta-Analysis of Interventions to Increase Colorectal Cancer Screening (Study 1)

2.1. Introduction

Although colorectal cancer (CRC) still figures prominently among the most commonly diagnosed cancers in both men and women (as outlined in Chapter 1), recent reports suggest that CRC incidence and mortality rates have been stabilising or declining for several decades (Arnold et al., 2016). A recent analysis on CRC statistics conducted by Siegel and colleagues (2017), reported that the rate of CRC death in the US has declined by approximately 2% per year during the 1990s and by approximately 3% per year over the last decade. In the UK, CRC mortality rates have decreased by 42% since the early 1970s and between 2003 and 2014 rates have decreased by approximately 12% (Office of National Statistics, November 2015). The reasons for the recent declining trends in incidence are diverse and ill-defined but seem to be driven by two main reasons; firstly, by historical changes in risk factors, including lifestyle factors (e.g., decreased smoking, increased use of aspirin), and secondly, by the introduction of population-based screening programmes, that have facilitated the dissemination of early detection tests. Notably, screening is estimated to be the most important driver of the observed decline in CRC incidence and mortality over the past decades (Edwards et al., 2010). Together changes in risk factors and the implementation of screening programmes, improvements in cancer treatment – including perioperative care, chemotherapy and radiation therapy – have also contributed to improved overall survival and reduced recurrence of cancer (André et al., 2009; Center, Jemal, & Ward, 2009; Murphy, Harlan, Lund, Lynch, & Geiger, 2015).

Despite the effectiveness of screening and the increased accessibility of screening since the introduction of stool-based screening tests, uptake rates are alarmingly low and patterned by SES and ethnic background, and previous studies have demonstrated that a substantial percentage of CRC deaths are attributable to nonuse of screening (Altobelli et al., 2014; Dubé, 2012; Meester et al., 2015). Therefore, it is important, from a public health perspective, to identify which interventions make the greatest contributions for: a) increasing CRC screening uptake across the whole of the population, and b) reducing the

observed inequalities in CRC screening uptake. A greater understanding of the approaches that are effective in maximising screening participation is vital for prioritising future interventions. Previous studies and reviews in the CRC screening literature has predominantly focused on epidemiological analyses that examine the effectiveness of screening programmes in reducing CRC incidence and mortality, or the test performance characteristics of the different screening tests for detecting CRC – that is, examining metrics relating to the accuracy, specificity and sensitivity of screening methods to detect cancer - and the potential adverse effects that different screening tests may present with (Heresbach, Manfredi, D'halluin, Bretagne, & Branger, 2006; Lin et al., 2016; Whitlock, Lin, Liles, Beil, & Fu, 2008). An ample number of reviews and meta-analyses have also focused on the prevention of colorectal cancer. For example, Bjelakovic, Nikolova, Simonetti and Gluud (2004) examined the potential preventive effects of antioxidant supplements for the prevention of gastrointestinal cancers; Aune and colleagues (2011) examined whether increased intake of whole grains and dietary fibre reduced the risk of colorectal cancer; and Papaioannou et al (2010) looked at the effect of chemopreventive agents, such as aspirin, folic acid and calcium, on colorectal cancer incidence. Other meta-analytic reviews have examined the associations between lifestyle factors such as excess body weight (Harriss et al., 2009; Renehan, Tyson, Egger, Heller, & Zwahlen, 2008) or cigarette smoking (Liang, Chen, & Giovannucci, 2009) and the incidence of colorectal cancer.

Reviews and/or meta-analyses that have examined intervention effectiveness in increasing CRC screening uptake are scarce in the existing literature. A systematic review by Sabatino and colleagues (2008) presented results on the effectiveness, applicability, economic efficiency and barriers to implementation of *provider-directed* interventions, to increase screening uptake for breast, cervical and colorectal cancers. The findings indicated that interventions that incorporate healthcare provider assessment and feedback can increase screening for all three types of cancer. In contrast, Baron et al. (2008) conducted a systematic review on the effectiveness of different classes of *patient-directed* interventions – including patient reminders or recall, patient incentives, small media, mass media and group education - to increase breast, cervical and colorectal cancer screening. The evidence from this review suggested that reminders and the use of small media (e.g. videos, written

materials) led to important increases in screening uptake for all three cancers. Both of these reviews are limited by their narrative approach and by their focus on either provider-directed or patient-directed interventions respectively. Additionally, an important limitation of these reviews is that they do not provide specific, actionable guidance as to which interventions are best-suited for increasing screening uptake among populations with traditionally lower uptake rates, such as low SES and BAME populations, which compromises their capacity to inform public health policy on how to combat such disparities. For instance, despite general success of patient reminders in increasing screening uptake, this approach might not be as successful among socioeconomically deprived and ethnically diverse communities, where more intensive interventions (e.g., interventions that incorporate educational and motivational components to raise awareness about cancer screening) might be necessary in order to promote screening participation among non-screeners or under-users of screening services.

Given the lack of meta-analytic reviews in this area of research, the present systematic review and meta-analysis was conducted, in order to: firstly, address the limitation of previous reviews, and secondly, provide the most up-to-date and comprehensive quantitative overview on the effectiveness of interventions to increase CRC screening uptake. This review also aimed to examine intervention effectiveness by level of SES, which has not been a focus in any of the currently available, published reviews. Moreover, the present review examined four groups of moderators in order to identify factors associated with increased intervention effectiveness. The rationale for examining each moderator and a more detailed overview of the aims of the systematic review and meta-analysis are outlined in the sections below.

2.1.1. Intervention Characteristics as Moderator Variables

2.1.1.1. Intervention delivery mode

One factor that should be considered for its potential impact on intervention effectiveness is the choice of intervention delivery mode. A growing body of research has shown that patient receptivity and the acceptability of health-related information, partly relies on the way that health messages are presented and delivered, and that a common oversight in research is that these factors are overlooked in both the planning and implementation phases of healthcare interventions, potentially compromising, the ability to sustain long-

lasting intervention effects (Freimuth & Mettger, 1990; Lambert, Loiselle, & Macdonald, 2009; Sekhon, Cartwright, & Francis, 2017). The importance of mode of delivery has been examined by previous studies but this has been either within the context of physical activity research (Beall, Baskerville, Golfam, Saeed, & Little, 2014; Foster, Richards, Thorogood, & Hillsdon, 2013), cardiovascular medication adherence (Cutrona et al., 2010), or obesity prevention, weight loss and dietary change (Greaves et al., 2011; Kozica et al., 2015). Authors have also frequently examined specific delivery modes in isolation; for instance a number of meta-analyses have focused on evaluating which characteristics of internet-based interventions alone best promote health behaviour change (Lustria et al., 2013; Maher et al., 2014; van Genugten, Dusseldorp, Webb, & van Empelen, 2016; Webb, Joseph, Yardley, & Michie, 2010), some studies have only examined the effectiveness of computer-delivered interventions (Portnoy, Scott-Sheldon, Johnson, & Carey, 2008) and others have evaluated the impact of mobile phone and text messaging interventions (Wei, Hollin, & Kachnowski, 2011). However, within the context of cancer screening, there is little evidence available comparing all the available modes of delivery with regards to screening uptake, indicating a gap in the evidence base. In order to address this gap, the present meta-analysis sought to examine whether intervention effectiveness varied as a function of three dimensions relating to mode of delivery; *first*, it was examined whether interventions were delivered remotely or face-to-face, *second*, whether interventions were individual- or group-based and *third*, what types of materials were used to deliver the intervention (e.g., written, electronic, phone).

With regards to the first dimension, both face-to-face and remote delivery modes have their advantages and disadvantages. A commonly mentioned advantage for interventions that are delivered face-to-face is that intervention providers can better engage participants in open dialogue about their own healthcare, which has been associated with greater informed decision-making and willingness to take independent actions to manage their health (Alston et al., 2012; Carman et al., 2013; Couët et al., 2015; Hibbard & Greene, 2013). Several articles have shown that engaging participants in conversation about their own medical decisions leads to improved understanding and awareness about their healthcare options and more accurate expectations of anticipated benefits and harms pertinent to the health behaviour of interest (Drew, 2006;

Maynard & Heritage, 2005). Delivering public health interventions face-to-face might provide an opportune moment for interventionists to, on the one hand, communicate the importance of strategies and messages that are effective in raising awareness about CRC screening, and for patients on the other hand, to interact with the healthcare system and become engaged in their own health. The synergistic action of these two components has been recognised for its potential to improve the health of populations and individual patients (Légaré et al., 2014; Légaré & Witteman, 2013). Another advantage of face-to-face intervention delivery is that the interpersonal interaction between participants and interventionists is more likely to generate empathy(Moyers, Miller, & Hendrickson, 2005), which may be an element that contributes to increased intervention effectiveness through the elicitation of rapport, which is difficult to establish with distal delivery modes where the interpersonal interaction is lacking.

Another aspect that may have an impact on the effectiveness and acceptability of interventions – and one that has yet to be examined with respect to CRC screening uptake - is whether interventions are being delivered on a one-to-one or group basis. A systematic review by Baron and colleagues (2008) identified only one study that reported using group education and only two studies that used one-to-one education to increase screening by gFOBT. For both modes of delivery the authors reported that there was insufficient evidence to evaluate intervention effectiveness and therefore the general applicability of these approaches to CRC screening was not addressed, nor was the comparison between the two approaches feasible. It therefore remains unclear whether one-to-one education is more effective than group education in promoting CRC screening. Comparing individualised and group-based modes of delivery within the context of bowel cancer might be particularly important as it represents a sensitive, health-related topic and the absence of anonymity within a group setting might have an impact on participants' willingness for conversation and self-disclosure with regards to their perceptions, beliefs and attitudes on the topic of interest. Studies of emotion are increasingly demonstrating that CRC screening methods can stir a number of aversive affects, including embarrassment, fear and disgust (both experienced and anticipated), which have been characterised as 'the affective substrates of avoidant behaviour in the CRC context' (Consedine, Reynolds, & Borg, 2017;

Reynolds, Consedine, Pizarro, & Bissett, 2012, pg. 2). It might be that such emotions are exacerbated if these, traditionally private, topics are discussed within a group setting where confidentiality and anonymity cannot be ensured.

Both qualitative (Holt et al., 2012; Honein-AbouHaidar et al., 2016; Tarasenko, Wackerbarth, Love, Joyce, & Haist, 2011) and quantitative (Bynum, Davis, Green, & Katz, 2012; Robb, Solarin, Power, Atkin, & Wardle, 2008; Shi, Lebrun, Zhu, & Tsai, 2011) research into the public perceptions of bowel cancer and screening, suggests that bowel cancer stigma is partly driven by the negative perceptions surrounding the CRC screening process. Evidence suggests that the collection of faecal samples is generally considered unsanitary and frequently described as 'disgusting', 'repulsive' and 'dirty' (Javanparast, Ward, Carter, & Wilson, 2012), people often feel apprehensive about being subjected to screening procedures that require the insertion of an endoscopic instrument into the anus (e.g., for a digital-rectal exam) (Greisinger, Hawley, Bettencourt, Perz, & Vernon, 2006), or about undergoing invasive treatment, such as colostomy, chemotherapy and/or surgical removal of tumors, in the event of a cancer diagnosis. Negative attitudes towards CRC screening, paired with the aforementioned aversive emotional barriers, have contributed to the stigmatisation of CRC screening, which is one of the driving factors negatively influencing people's engagement with both primary and secondary prevention behaviours (Azaiza & Cohen, 2008a, 2008b; Bynum et al., 2012; Matthews, Berrios, Darnell, & Calhoun, 2006). Widespread negative beliefs and connotations associated with CRC screening might also affect how receptive people are to cancer-related health promotion materials, and particularly so if these are delivered within the context of group-based health interventions. It might be that the acceptability of screening- and cancer-related messages is compromised within a group setting due to the stigma associated with CRC. Within this context, it has yet to be examined whether intervention effectiveness varies as a result of group versus individualised modes of delivery. Another mode of delivery domain that might have an impact on intervention effectiveness is the communication channel through which healthcare interventions are delivered (e.g., written, electronic, phone, in-person), which is another area that remains under-researched with regards to CRC screening.

2.1.1.2. Intervention provider

Despite past research identifying intervention provider as an important factor to consider with regards to intervention effectiveness, previous reviews and meta-analyses in the CRC screening literature have not examined this as a potential moderator of intervention effectiveness. Cutrona and colleagues (2010) examined what the optimal modes of delivery were with respect to improving cardiovascular medication adherence and found that patient receptivity to adherence-related messages varied as a result of the intervention provider's professional training (e.g., lay person, pharmacist, physician). Additionally, there is some evidence to suggest that the involvement of health workers and lay health advisors might be particularly beneficial in implementing interventions within the community and/or interventions that target ethnic and racial minorities and socioeconomically deprived populations (Gorin et al., 2006; Holmes et al., 2008; Palmer & Schneider, 2005; Shavers, Fagan, & McDonald, 2007). Low SES and ethnic minority populations might respond better to interventions delivered by community health advisors partly because these individuals are frequently perceived as liaisons between the healthcare system and their local community, and are uniquely positioned to communicate health-related information to target groups through their existing social networks to which they themselves belong to (Kaiser, Thomas, & Bowers, 2017; Verhagen, Steunenberg, de Wit, & Ros, 2014). The fact that lay health educators are 'rooted' within the community and hold indigenous knowledge enables them to handle intervention delivery with greater cultural sensitivity and to adapt their communication style to the cultural context of their local communities.

2.1.1.3. Intervention setting

The intervention setting has also been recognised as a factor that can have impact on intervention effectiveness. For instance, community-based interventions – and especially those that incorporate an intervention development phase employing participatory research methods – are considered the current 'gold standard' for eliminating disparities in clinical and public health systems and population status. This might partly be driven by the fact that community-based interventions offer participants the opportunity to connect with aspects of their social environment, which can enforce collaborative/community decision-making and even encourage collective action for behaviour change (Anderson, Scrimshaw, Fullilove, & Fielding, 2003; Swan, 2009; Wallerstein &

Duran, 2010). Yet it remains unanswered whether community-based interventions are more effective than those implemented within a primary care setting with regards to CRC screening. Questions about the role that factors, such as the mode of delivery, the setting and the provider, have to play have yet to be sufficiently examined within this context and the investigation of such intervention components can direct attention to questions of what interventions to apply, with which target population and under what conditions.

2.1.1.4. Intervention screening modality

The screening modality used may also influence intervention effectiveness. Participants may be more or less receptive to preventive health messages depending on whether the screening procedure is endoscopic or non-endoscopic in nature. What might attract patients to endoscopic procedures (i.e., colonoscopy, computed tomographic colonography (CTC), double-contrast barium enema, flexible sigmoidoscopy) is that they are diagnostic in nature and they involve the examination of the entire colon during which polyps can be removed. It is also not uncommon to diagnose other diseases, not limited to CRC, that were undetected until then, which is seen by many as an added benefit of endoscopic tests. However, the two main limitations of endoscopic screening procedures is that they are not particularly cost effective for countries with universal health systems such as the UK, and they are also associated with greater risks of bowel tears and infections, that are not present with the noninvasive, stool-based tests. The invasiveness of endoscopic screening methods may engender a greater sense of fear, discomfort or concern and might elicit unpleasant emotions such as shyness and anxiety, which could serve to prevent screening uptake. For instance, a study by Adler and colleagues (2014) found that patients that had previously refused to undergo a colonoscopy were more likely to accept a noninvasive FIT test and approximately five times more likely to accept a blood test as an alternative method for CRC screening (i.e., a method based on the detection of methylated Septin9 DNA in patient plasma), demonstrating that the level of invasiveness associated with each screening method is an important determinant of CRC screening uptake. Additional evidence suggests that colonoscopy is associated with reduced CRC screening uptake, especially among racial and ethnic minorities and that providing the option of a stool-based test, or being a given a choice between stool-based tests or a

colonoscopy, can result in significantly greater screening uptake rates (Inadomi et al., 2012). Therefore, the current meta-analysis also sought to examine whether intervention effectiveness varied as a result of test modality.

2.1.1.5. Use of theory

The use of theory in interventions that aim to increase colorectal cancer screening uptake has also not been systematically assessed by previous reviews, and therefore, theory application and its impact on behaviour change remains unaddressed within the context of cancer screening (Lippke & Ziegelmann, 2008; Threlfall et al., 2014; Wallace, Brown, & Hilton, 2014) Given that more than half of all CRC deaths that occur each year are attributed to the nonuse of screening, and given that screening uptake is, in and of itself, a detection *behaviour*, it can be suggested that the development of theory-driven interventions that target modifiable, behavioural factors, could demonstrate substantial public health benefits. Only a small number of studies in the cancer screening literature have directly used behavioural science theories as a basis for developing intervention strategies; for example, Sheeran and Orbell (2000) examined whether the formation of implementation intentions increased attendance for cervical cancer screening and another study by Champion, Foster and Menon (1997) examined the usefulness of theories in tailoring health promotion messages to increase health-protecting behaviours. Although studies that directly use behavioural science theories in the planning, development and implementation phases of interventions seem scarce, it is suspected that many of the existing interventions targeting health behaviours will often have foundations in behavioural science theory (Jamtvedt, Young, Kristoffersen, O'Brien, & Oxman, 2006; Legler et al., 2002), but an important limitation is that interventionists themselves might have a moderate or poor level of awareness of theory and theoretical constructs that are used in their interventions. For instance, Glanz and Bishop (2010) summarise the findings from a series of interviews with 59 programme-development coordinators and 61 recruitment coordinators responsible for developing programmes organised by the National Breast and Cervical Cancer Early Detection Program (NBCCEDP), in order to assess the extent to which evidence-based cancer prevention strategies were used in programmes aiming to increase access to breast and cervical cancer-screening services for medically underserved women. Interviewees were asked about the theories they used to develop their

intervention strategies; responding coordinators often listed a number of different theories – the most commonly mentioned theories were adult learning theory, social influence theory, diffusion of innovation and stages of change – or they responded by simply listing a concept or a term, but not a theory. Others indicated that a theory was used to design the intervention but that they could not remember what it was called, indicating that practitioners, who are often responsible for organising large-scale public health programmes, are largely unaware of the role that theory might have in their interventions. It is vital to obtain a clear understanding of how current public health practitioners, and interventionists in general, are using theory and whether the lack of substantial impact often seen in community-based health promotion programmes (Merzel & D'Afflitti, 2003; Thompson, Coronado, Snipes, & Puschel, 2003) is due, in part, to weaknesses in the application of existing theoretical models. In the context of CRC screening, a question is raised relating to whether existing studies, that claim the use of behavioural science theory in developing their interventions, focus only on changing screening behaviours by facilitating initial compliance, or whether they also examine the intervention's impact on maintaining behaviour change. This is particularly relevant for screening programs that use stool-based screening tests, whose capacity to decrease CRC mortality heavily depends on repeat-screening every two years. The current meta-analysis sought to systematically examine the extent to which theory use affected CRC screening uptake.

2.1.2. Participant Characteristics as Moderator Variables

Another substantial limitation of currently published reviews in this area, is that they refrain from identifying differential intervention effectiveness for specific populations. Specifically, they offer little insight into the applicability of different approaches and interventions among populations that are traditionally deemed as *hard-to-reach* – including socioeconomically deprived, black and ethnic minority (BEM) and medically underserved populations.

Other patient-level attributes also remain insufficiently examined within this context. For instance, there is a basis for investigating gender as a moderator of health intervention effectiveness to increase CRC screening uptake since gender differences in screening uptake, as well as the variation in determinants of screening participation by gender, have been documented in several studies. For instance, Friedemann-Sanchez and colleagues (2007)

examined CRC screening barriers, attitudes and preferences by gender and found that, although both men and women reported similar preferences for CRC screening modalities, they also reported notable differences relating to modality-specific barriers and facilitators. For example, both genders reported experiencing fear regarding endoscopic screening procedures, but women expressed these fears as being predominantly affective while men communicated theirs as being primarily physical. Such differences may explain part of the gender differences observed in utilisation of different screening modalities. Findings across the UK and the US suggest that screening uptake is higher among men for more invasive procedures (i.e., endoscopic screening modalities) than it is for women (Ananthakrishnan, Schellhase, Sparapani, Laud, & Neuner, 2007; McGregor, Hilsden, Li, Bryant, & Murray, 2007; Meissner, Breen, Klabunde, & Vernon, 2006; Wardle, Miles, & Atkin, 2005). However, the evidence regarding gender differences with regards to gFOBT adherence in the US is fairly inconclusive; some results based on National Health Interview Surveys report no significant differences in the prevalence of gFOBT by gender (Meissner et al., 2006), some report that female gender is associated with decreased screening (Wernli et al., 2014), while others document rates of 1-4% higher among women compared to men (Clarke, McNamara, et al., 2016; Joseph et al., 2012; Steele et al., 2013). In the UK, the current evidence base suggests that gFOBT rates have higher uptake in women than in men. For instance, in the Nottingham gFOBT trial uptake was 51% for men and 55% for women (Hardcastle et al., 1996). Findings from both the first and second evaluation reports of the English Pilot of Bowel Cancer Screening reported significantly lower gFOBT uptake among men compared to women (52.1%, 47.7% for men and 61.4%, 56.2% for women for the first and second pilot respectively) (Weller et al., 2007b) and in another study, conducted on behalf of the English Bowel Cancer Screening Evaluation Committee, the authors examined early outcomes regarding uptake of gFOBT screening after the first one million invitations (i.e., sent out between June 2006 and October 2008) and documented rates of 49.6% for men and 54.4% for women (Logan et al., 2012). Similarly, the most recent Key Performance Indicators (KPI) report for the Scottish Bowel Cancer Screening Programme, published in August 2017, has noted similar findings; gFOBT uptake was higher in women than men with rates of 60.1% and 53.8% respectively (Scottish Bowel Screening Programme

Statistics, 2017). Whether gender has an impact on intervention effectiveness to increase CRC screening uptake – irrespective of the screening modality used - has not been examined, and therefore this meta-analysis aimed to assess whether intervention effectiveness varied by gender.

Similarly, the age of participants has not been examined in meta-analysis moderator analyses, however, differences in CRC screening uptake by age have been observed. The evidence on whether uptake rates are more favourable for older or younger participants remains inconsistent (Denberg et al., 2005; Klabunde, Meissner, Wooten, Breen, & Singleton, 2007), but understanding whether intervention effectiveness varies by age, among other sample characteristics, may lead to more personalised care. The literature suggests that having a family history of CRC is another factor that should be considered as it is known to influence CRC screening uptake. Studies show that CRC screening uptake among individuals with a family history is higher compared to those without a family history (Janssen, van Osch, de Vries, & Lechner, 2011; Kim et al., 2008; Murphy et al., 2015).

Further studies suggest that having a family history of cancer makes the risk of the disease more salient and have found that increased perceived risk acts as a strong predictor of cancer screening uptake among individuals with a family history (DiLorenzo et al., 2006; Peipins et al., 2015). Greater perceived risk and vulnerability are known to motivate medical decisions and health behaviours and it is likely that greater CRC risk perceptions might affect one's interpretation of cancer-related risk messages and increase engagement with cancer screening recommendations, compared to those with lower perceived risk (Han, Moser, & Klein, 2007). Interventions targeting CRC screening uptake almost universally provide information about cancer and the risks associated with non-participation (also referred to as risk communication interventions) and therefore it was considered useful for the present meta-analysis to examine whether intervention effectiveness varied as a function of the proportion of people within the sample with a family history of CRC.

Participants' screening status at time of study was also believed to be a potential moderator; psychological research concerned with the antecedents of health behaviour change postulates that past behaviour is a central precursor of future behaviour (Ouellette & Wood, 1998). Based on this principle, it would be logical to presume that intervention effectiveness would increase if more

participants within the sample were up-to-date with CRC screening at baseline. However, CRC screening is a rather idiosyncratic type of behaviour, in that it does not occur regularly enough to be considered habitual. Rather, CRC screening occurs occasionally (every two years when using a stool-based test or every five years for a colonoscopy). Unlike habitual behaviours, it is not clear whether past behaviours that occur occasionally strongly predict future screening, hence the need for examining screening uptake at baseline as a potential moderator.

2.1.3. Methodological Characteristics as Moderator Variables

Furthermore, existing reviews have not considered the methodological heterogeneity between studies as a contributing factor to intervention effectiveness (or lack of). Interventions in the colorectal cancer screening literature are varied in terms of setting, provider, mode of delivery, the extent to which theory was used to develop the intervention, screening modality and other methodological quality parameters, which are all aspects likely to influence intervention effectiveness. Scant evidence exists comparing multiple possible interventions in the context of CRC screening, which is problematic for identifying which interventions, or which intervention characteristics, will work best and for which populations. There is increasing recognition that the way in which complex social and public health interventions are organised and implemented can impact on their ability to achieve behaviour change (Bambra et al., 2009; Beall et al., 2014; Conn, Ruppar, Phillips, & Chase, 2012; Hillier-Brown et al., 2014).

2.1.4. Behaviour Change Techniques (BCTs) as Moderator Variables

Another limitation of currently published reviews is that they exclusively examine the use of patient reminders as a behaviour change technique (BCT), however they fail to assess the impact of other BCTs on intervention effectiveness. Indeed, in recent years a number of taxonomies, identifying specific BCTs, have been developed (Abraham & Michie, 2008; Michie et al., 2011; Michie et al., 2013). These taxonomies are used to specify behavioural intervention components, the presence of which might be what determines the observed differences in effect between one intervention and another, or between the intervention and control groups. The process of breaking down complex, multi-component interventions, into active ingredients that can be

specified and categorised, aids the making of direct links between which aspects are associated with increased intervention effectiveness. Understanding what drives the difference in effects holds enormous potential and is likely to influence the degree to which future public health interventions are going to have successful outcomes.

Collectively the information presented here suggests that existing reviews have considerable methodological shortcomings, which, to a certain extent, compromise the quality of evidence and the capacity of these reviews to inform health policy. The current meta-analytic review aims to address the limitations outlined above in relation to previous reviews and to provide the most up to date (including studies published until October, 2016) and comprehensive quantitative overview of interventions aiming to increase colorectal cancer screening uptake.

2.1.5. Aims

The purpose of the present study was to conduct a meta-analytic review of randomised controlled trials (RCTs) to identify the overall effectiveness of interventions to increase CRC screening uptake and to identify successful strategies for behaviour change that can be used to guide intervention development. A particular focus of this meta-analysis was to examine whether interventions were more effective for socioeconomically deprived versus non-deprived populations and to ascertain whether specific intervention features and BCTs were beneficial in increasing screening uptake, specifically for disadvantaged populations in comparison to higher socioeconomic status populations. As outlined earlier, several variables were expected to influence the impact of health interventions on CRC screening uptake. Therefore, the present review examined four groups of moderators in order to identify factors associated with increased intervention effectiveness. The *first* category of moderator variables related to participant characteristics and it was examined whether intervention effectiveness varied by sample age, gender, family history of CRC and participants' screening status at the time of the study. The *second* category of moderators related to intervention characteristics where it was investigated whether factors such as mode of delivery, setting, provider characteristics, screening modality and reported use of theory are associated with improved screening uptake. The *third* category of moderator analyses related to methodological characteristics of the included studies and specifically:

a) whether the outcome variable was measured objectively or through self-report; and b) whether the study quality was judged as having low, unclear or high risk of bias. A *fourth* category of moderator variables was dedicated to assessing the effectiveness of individual BCTs in improving screening uptake, the identification of which was based on the taxonomy proposed by Michie et al (2013). Each of these variables was considered as having the potential to influence intervention effectiveness and the studies reviewed here provided data regarding these characteristics.

2.2. Method

2.2.1. Protocol Registration

The protocol for this systematic review and meta-analysis was pre-registered with the International Prospective Register of Systematic Reviews (PROSPERO) database (registration number: CRD42016033782, 14/01/2016). Details of the protocol can be viewed in Appendix 2.1.

2.2.2. Data Sources and Searches

The electronic databases MEDLINE (1950-), EMBASE (1947-), and PSYCINFO (1806-) were searched using Ovid (date of last search: 24/10/2016). The search strategy was developed on the basis of the PICOS framework; a technique used to formulate focused health related research questions by setting inclusion criteria relating to participants, interventions, comparisons, outcome(s) and study design. The search strategy was also informed by two previous systematic literature reviews (Baron et al., 2008; Holden, Jonas, Porterfield, Reuland, & Harris, 2010) and identified studies that examined the impact of any given intervention, including patient-directed and physician-directed interventions, on CRC screening uptake (Ferreira et al., 2005; Myers et al., 2007).

The search was performed using the *explode* (exp) function available when using the Ovid interface, combined with Medical Subject Heading (MeSH) terms and keywords that related to screening for colorectal cancer (e.g., exp colorectal cancer OR colorectal neoplasms) AND (exp intervention study OR health promotion OR behaviour change) AND (exp cancer screening OR health education OR early diagnosis). This review did not augment the literature search by conducting manual searches of reference lists of relevant studies or

additional systematic and narrative reviews. The search was restricted to English-language studies and articles published in peer-reviewed journals.

The present meta-analysis only included studies that adopted a RCT study design, however, this was not a primary focus at the start of the review and therefore the chosen study design is not reflected in the review search strategy. Despite initially searching the databases for all study designs, the decision to restrict to RCTs only was justified by two main reasons: *firstly*, it has been argued that meta-analyses seeking to examine the effects of interventions should be limited to RCTs because the RCT design eliminates the influence of confounding variables and minimises the threat of selection bias due to random allocation of participants to study condition, which is increased in non-randomised studies of interventions (NRSIs) (Odgaard-Jensen et al., 2011). Within the context of evaluating healthcare interventions, RCTs are widely accepted as the ideal research design (but the critical appraisal of trial quality is equally vital) for obtaining unbiased estimates of intervention effects and are placed at the top of the evidence hierarchy(Evans, 2003). *Secondly*, the inclusion of NRSIs would have been necessary had there been a lack of adequately-sized RCTs identified through the database search that addressed the research question of interest. This pertains to a common criticism against the selection of RCTs only for inclusion in meta-analyses, which is that RCTs will often have smaller sample sizes - partly due to greater recruitment challenges associated with conducting RCTs - compared to NRSIs. Small-sized trials are often underpowered, more prone to chance effects and at a greater risk for biased reporting (Counsell, Clarke, Slattery, & Sandercock, 1994; Egger, Smith, Schneider, & Minder, 1997; Kunz & Oxman, 1998). However, in meta-analyses the power of individual studies is not thought to influence the precision of the findings, since the evidence from all studies is pooled to provide a collective estimation of intervention effectiveness. Furthermore, within the context of the present meta-analysis, the average number of participants per RCT was approximately 19,000 with a cumulative number of participants above 1.9 million, which was considered large enough to ensure that the aforementioned sources of bias do not pose a substantial threat to the reliability of the findings discussed here.

An initial search was conducted in December 2014 and was updated in October 2016 to ensure that the search was as current as possible. The same

search strategy was used with all databases applying appropriate alterations analogous to each database's interface where necessary. Studies were considered irrespective of type of intervention, which is reflected in the wide range of search terms used to identify potentially eligible studies (see Table 2.1).

Table 2. 1. Meta-analysis search strategy

Embase	PsycInfo	Medline	Notes
Step 1: Intervention			
Embase	**PsycInfo**	**Medline**	**Notes**
1. intervention study/ 2. intervention*.tw. 3. health promotion/ 4. patient navigat$.tw. 5. reminder$.mp. 6. incentive$.mp. 7. reduc$ cost.mp. 8. mass medium/ 9. attitude to health/ 10. health behavior/ 11. health belief/ 12. health belief model/ 13. risk reduction/ 14. behavio?r change/ 15. Social Cognitive Theory/ 16. persuasive communication/ 17. "theory of planned behavior"/ 18. message fram*.mp. 19. implementation intention$.mp. 20. protection motivation theory.mp. 21. social cognition model$.mp. 22. self efficacy.mp. 23. or/ 1-22	1. intervention/ 2. intervention*.tw. 3. exp Health Promotion/ 4. patient navigat$.tw. 5. reminder$.mp. 6. incentive$.mp. 7. reduc$ cost.mp. 8. mass media/ 9. health attitudes/ 10. health behavior/ 11. health belief*.mp. 12. health belief model.mp. 13. exp Behavior Change/ 14. social cognitive theory.mp. 15. exp Persuasive Communication/ 16. exp Reasoned Action/ 17. message fram*.mp. 18. implementation intention$.mp. 19. protection motivation theory.mp. 20. social cognition model$.mp. 21. exp Self Efficacy/ 22. or/1-21	1. Intervention Studies/ 2. intervention*.tw. 3. Health Promotion/ 4. patient navigat$.tw. 5. reminder$.mp. 6. incentive$.mp. 7. reduc$ cost.mp. 8. Mass Media/ 9. Attitude to Health/ 10. Health Behavior/ 11. health belief*.mp. 12. health belief model.mp. 13. behavio?r change.mp. 14. social cognitive theory.mp. 15. Persuasive Communication/ 16. theory of planned behavio?r.mp. 17. message fram*.mp. 18. implementation intention$.mp. 19. protection motivation theory.mp. 20. social cognition model$.mp. 21. Self Efficacy/ 22. or/1-21	/ = MeSH term */$ = Truncation .tw = title, abstract .mp = title, abstract, subject heading Exp = explode search ? = letter may appear or not
Step 2: Type of Cancer			
COLORECTAL CANCER (including medical terminology and synonyms)			
Embase	**PsycInfo**	**Medline**	**Notes**
24. colorectal cancer/ 25. bowel cancer.mp. 26. colon cancer/ 27. rectum cancer/ 28. (colorectal adj2 neoplasm$).mp. 29. or/24-28	23. colorectal cancer.mp. 24. bowel cancer.mp. 25. colon cancer.mp. 26. rect* cancer.mp.	23. colorectal cancer.mp. 24. bowel cancer.mp. 25. colon cancer.mp. 26. rect* cancer.mp.	/ = MeSH term .mp = title, abstract, subject heading Adj = adjacent $ = truncation

	27. (colorectal adj2 neoplasm$).mp. 28. or/ 23-27	27. colorectal adj2 neoplasm$).mp. 28. or/23-27	
Step 3: Outcomes			
Adherence/Compliance to Screening (for all methods of CRC screening) in middle aged populations			
Embase	**PsycInfo**	**Medline**	**Notes**
30. cancer screening/ 31. self examination/ 32. cancer prevention/ 33. health education/ 34. health literacy/ 35. health promotion/ 36. health kowledge.mp. 37. early diagnosis/ 38. patient compliance/ 39. patient adherence.mp. 40. health care access/ 41. barium enema.mp. 42. endoscop$.mp. 43. f?ecal occult blood.mp. 44. occult blood/ 45. occult blood test/ 46. occult blood.mp. 47. or/30-46	29. cancer screening/ 30. "self examination (medical)"/ 31. cancer prevention.mp. 32. health education/ 33. health literacy/ 34. health promotion/ 35. health knowledge/ 36. early diagnosis.mp. 37. treatment compliance/ 38. patient adherence.mp. 39. health care services/ 40. barium enema.mp. 41. endoscop$.mp. 42. f?ecal occult blood.mp. 43. occult blood test.mp. 44. or/29-43	27. cancer screen*.mp. 28. self-examination.mp. 29. cancer prevention.mp. 30. Health Education/ 31. Health Literacy/ 32. Health Promotion/ 33. Health Knowledge, Attitudes, Practice/ 34. Early Diagnosis/ 35. treatment complicance.mp. 36. Patient Compliance/ 37. Health Services Accessibility/ 38. barium enema.mp. 39. endoscop$.mp. 40. f?ecal occult blood.mp. 41. occult blood test.mp. 42. or/ 27-42	/ = MeSH term .mp = title, abstract, subject heading */$ = truncation ? = letter may appear or not

Note. The 'OR' Boolean function was used in Step 1, Step 2 and Step 3. Then the three separate steps were combined using the 'AND' Boolean function in order to retrieve papers to be assessed for eligibility

2.2.3. Study Selection

The *first* criterion for inclusion in the meta-analysis was that the intervention had to directly target CRC screening uptake. Studies were included regardless of screening modality and therefore the review contains studies that used both non-endoscopic screening procedures, including the gFOBT and FIT, as well as endoscopic screening procedures, including FS, SC or barium enema. The *second* criterion for inclusion was that studies adopted a RCT study design, where participants were randomly assigned to a treatment group,

which received an intervention to increase CRC screening uptake, and a comparison group, which received either a control intervention or no intervention. The *third* criterion for inclusion was that the intervention outcome had to be measured and reported quantitatively to enable the calculation of an effect size. The *fourth* criterion for inclusion was that each study had to report original data not reported in another paper in order to avoid inflating effect sizes. The *fifth* criterion for inclusion was that studies had to involve participants aged 50 years or older. The *sixth* criterion for inclusion was that studies had to involve participants without a prior or current personal history of CRC. The *seventh* criterion for inclusion was that studies had to be published in English language and in peer-reviewed journals. There was no restriction in year of publication. Studies were excluded if they were an abstract, a dissertation, a review, a protocol, a poster, a think piece or guidelines.

This systematic review and meta-analysis was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, Altman, & Group, 2009). The PRISMA checklist encourages authors to describe eligibility criteria using the PICOS framework; a technique used to formulate focused health related research questions by setting inclusion criteria relating to participants, interventions, comparisons, outcome(s), and study design of the included studies. Table 2.2 outlines the inclusion criteria for studies included in the present review according to the PICOS framework.

Table 2. 2. Inclusion criteria using the PICOS framework

Component	Inclusion Criterion
Population(s)/ Participants	Studies were included if they recruited participants that were at least 50 years of age and had no personal history of bowel cancer (i.e., average risk populations).
Intervention	Studies were included if they tested the effect of an intervention (of any intensity) on increasing CRC screening uptake.
Comparison	Main interventions were compared against an inactive control (i.e., no-treatment or wait list control) condition and/or an active control and/or comparison intervention
Outcome	CRC screening uptake
Study Design	Randomised controlled trials

Titles and abstracts of all citations identified by the literature search were examined for relevance to the predefined inclusion criteria. After the removal of duplicate publications, the author initially screened titles and abstracts of studies retrieved using the search strategy to identify studies that are in accordance with the above-mentioned inclusion criteria. Ineligible studies were excluded and the reason of rejection was recorded. The full texts of these potentially eligible studies were retrieved and assessed for eligibility. The author extracted relevant information for the entirety of the studies and a second postgraduate student independently assessed 20% of the full text studies for inclusion in the review. Discrepancies were resolved through discussion.

2.2.4. Data Extraction and Quality Assessment

A standardised, pre-piloted form (See Appendix 2.2.) was used to extract data from the included studies for assessment of study quality and evidence synthesis. The data extraction form was piloted on 5% of the included studies and was modified accordingly to ensure that the form extracted information on all the relevant points of interest. To further facilitate subsequent moderator analysis, a data extraction Excel spreadsheet containing all the extracted information was created. The information employed for moderator analyses, included mean age of sample (as reported or as inferred when means were not reported[1]), gender composition (percent males, as reported), ethnic background (percent non-white, as reported), sample socioeconomic status/level of deprivation (studies were coded either as *low SES* or *non-low SES).* Studies were deemed as involving *low SES* populations in respect of: (1) poverty/SES status; (2) ethnic minority status; (3) education/literacy level; (4) geographical location – that is, areas described as disadvantaged or medically underserved. The allocation of studies to the *low SES* group was decided based on author-set criteria; the main reason for this was that the majority of studies did not report data for objective SES markers such as income, area or individual-level deprivation, educational attainment etc. Details of how studies were classified as being *low SES* can be viewed in Appendix 2.3.

Information was also extracted with regards to sample family history of CRC (percentage with family history, as reported), average number of past

[1] For studies that reported sample age only as a threshold (e.g., 60 years or older), the threshold age was used as the mean age of the sample. For studies that reported sample age only as a range (e.g., 60-74) the midpoint of the range was used as the mean age of the sample.

screening invites (which was reported for only two studies[2] and therefore this variable was not included in moderator analyses), baseline CRC screening rates (percentage screened at baseline, as reported), screening modality, intervention intensity (which was based on the number of contacts with the intervention and control group[3] as well as the total contact time[4], length of follow-up (as reported, in weeks), latency of screening uptake, coded as the average duration from screening invite to screening uptake (reported only for two studies[5] and therefore this variable was not included in moderator analyses), contact type (e.g., remote, in person or mixed contact), intervention format and mode (e.g., individual- or group-based and using paper-based or non-paper based materials respectively), intervention provider (e.g., clinically trained health professionals versus non-clinically trained health professionals) and intervention setting (primary care versus community setting).

Specifically, interventions were coded depending on whether they were delivered: (1) in person or (2) remotely; in the former, the intervention required real-time, face-to-face contact with an interventionist, whereas in the latter case, the intervention was not delivered face-to-face and was primarily delivered through a variety of delivery modes including standard mail, the internet and telephone. The intervention delivery format was categorised as being individual-based, if the intervention involved providing one-to-one health promotion, education, advice or counselling, as group-based, if the intervention involved group-based health promotion, education, advice or counselling, and as mixed, if the intervention included both aspects that were delivered individually and aspects that were delivered in a group. Intervention providers were classified as: (1) clinically-trained healthcare professionals (e.g., general practitioners, physicians, nurses), (2) non-clinically trained healthcare professionals (e.g., community health educators, patient navigators, health advisors), (3) research staff (academic staff, research assistants, students) and (4) some interventions were characterised as being ‘person-independent’ (also known as ‘no contact’ interventions) - that is, the intervention was delivered without direct, real-time

[2] Baker et al (2014); Cameron et al (2011)
[3] Total number of contacts was unclear and not consistently reported for the majority of the studies and therefore this variable was not included in moderator analyses
[4] Total contact time was reported for 14 studies and was unclear, not reported or not relevant for the remaining studies (e.g., for paper-based studies) and therefore was not included in moderator analyses.
[5] Baker et al (2014); Wardle et al (2016)

contact with an interventionist and relied exclusively either on paper-based materials, that were sent to participants through the post, or on electronic-based materials (e.g., text messages, electronic reminders). Intervention mode was classified as: (1) paper-based, if it involved the distribution of printed materials including brochures, leaflets, and standard screening invitations, (2) electronic-based, if it involved mobile applications, texting, the internet (e.g., internet-based chat room exchanges and use of websites), online educational videos and/or DVDs, (3) phone-based, if a telephone was used to facilitate the intervention and (4) as interventions that were delivered in person (i.e., material-independent interventions); this category included studies that did not involve any of the aforementioned materials and relied predominantly on interpersonal interactions between the intervention provider and the intervention recipient, including studies that involved patient navigation services [6], educational workshops or talks and/or any informal community gatherings to raise awareness about CRC screening. Intervention setting was classified as being either: (1) a community setting, if the intervention was delivered within community-based institutions such as churches, schools, voluntary organisations, and/or local community health centres or if it required the involvement of local communities within a certain neighbourhood, or (2) a primary care setting, if the intervention was delivered in a primary or secondary care facility such as GP practices, hospitals, primary care clinics and community pharmacies, among others. Studies were also coded for the type of screening modality they used and were classified as using: (1) endoscopic screening procedures (i.e., any procedure that requires viewing the bowel internally e.g., colonoscopy, sigmoidoscopy etc.), (2) non-endoscopic screening procedures, if they used stool-based screening tests and (3) studies that offered participants a choice to undergo either an endoscopic or non-endoscopic screening procedure. Information was also extracted on whether interventions incorporated reminders or not, and also on whether studies assessed screening uptake at follow-up either: (1) objectively, through the use of claims and/or administrative data or by accessing patients' electronic medical records (EMRs) or (2) through self-report.

[6] Patient navigation is a community-based intervention, which aims to reduce access barriers to cancer services for deprived and vulnerable populations (Freeman & Rodriguez, 2011).

Studies were also coded on the extent to which theory was used to develop the intervention. Specifically, studies were coded for their reported use of theory using the Theory Coding Scheme (TCS) proposed by Michie and Prestwich (2010), granted that studies mentioned the theory and/or model of behaviour in the *Introduction* or *Methods* sections of the paper. The TCS consists of 19 items that collectively enable the systematic assessment of reported theory-use by specifying, whether theory is mentioned (e.g., 'Is the theory/model of behaviour mentioned in the Introduction or Methods section of the paper?'), how theory is directly used in intervention design (e.g., 'Are theory/predictors used to select/develop intervention techniques?'), how theory indirectly influences interventions via the selection of participants (e.g., 'Is theory/predictors used to tailor intervention techniques to recipients?'), how theory explains intervention effects on outcomes (e.g., 'Are theory-relevant predictors and constructs measured?') and the implications of results for future theory development (e.g., 'Are results discussed in relation to theory?'). The extent of reported theory use was included in the moderator analyses by using a coding strategy similar to that outlined in a meta-analysis by Prestwich and colleagues (2014) that examined whether reported theory use influences the effectiveness of health behaviour interventions. The authors in that meta-analytic review combined certain items from the TCS to reflect the extent of reported theory use. Specifically, Prestwich and colleagues (2014) created three composite measures reflecting: *firstly*, the extent to which each BCT reported by the authors was linked to a theory-relevant construct (this aspect of theory use is reflected by items 7-9 items of the TCS[7]); *secondly*, the extent to which the constructs within the underlying theory were specifically targeted by the BCTs (this aspect of theory use is reflected by items 9-11 of the TCS[8]) and *thirdly*, an overall theory score on all of the TCS items that relate to the use of theory to develop an intervention (reflected by items 3-11 of the TCS[9]). Studies received

[7] Item 7: 'All intervention techniques are explicitly linked to at least one theory-relevant construct; Item 8: 'At least one, but not all, of the intervention techniques are explicitly linked to at least one theory-relevant construct'; Item 9: 'Group of techniques are linked to a group of constructs'

[8] Item 10: 'All theory-relevant constructs are explicitly linked to at least one intervention technique'; Item 11: At least one, but not all, of the theory relevant constructs are explicitly linked to at leas one intervention technique.

[9] Item 3: 'Intervention based on single theory'; Item 4: 'Theory used to select recipients for the intervention; Item 5: 'Theory used to select/develop intervention techniques'; Item 6: 'Theory used to tailor intervention techniques to recipients'

points depending on the extent of reported theory use for each of these three composite measures, ultimately resulting in a scale ranging from 0 (no theory use) to +8 (most extensive theory use). The same approach was applied to the present meta-analytic review and the intensity of reported use of theory was included in the moderator analyses as a categorical variable by being segregated into studies demonstrating sparse, moderate and extensive reported use of theory (with scores ranging from 0-2, 3-5 and 6-8 respectively; see Appendix 2.4. for a detailed assessment of reported theory use for each study). Additional items, that did not directly address the objective of examining the intensity of theory application in health interventions to increase CRC screening uptake, were not considered.

Risk of bias was assessed using the criteria set forth by the Cochrane Collaboration that are specific to the features of the RCT design. These are: (1) random sequence generation in order to check for selection bias (biased allocation to interventions) due to inadequate generation of a randomised sequence; (2) allocation concealment, to check for selection bias (biased allocation to interventions) due to inadequate concealment of allocations prior to assignment; (3) performance bias, to check for bias due to knowledge of the allocated interventions by participants and personnel during the study; (4) detection bias, to check for bias due to knowledge of the allocated interventions by outcome assessors; (5) attrition bias to check for bias due to amount, nature, or handling of incomplete outcome data; (6) selective reporting bias: to check for bias due to selective outcome reporting by comparing in-publication reporting of the outcomes of interest reported in the methods section to those reported in the results section. To further assess the methodological quality of studies information was extracted on whether the studies conducted intention-to-treat (ITT) analysis. The following judgments were used: low risk, unclear risk (due to either lack of information or uncertainty over the potential of bias) or high risk. A summary assessment of risk of bias across the seven domains was decided as follows; when studies provided sufficient detail across all the aforementioned domains they were classed as having low risk of bias. If insufficient detail was reported in terms of what happened in the trial relating to one or more of the key domains then studies were classed as having unclear risk of bias. Studies were considered as having high risk of bias if they failed to meet the criteria set forth by the Cochrane Risk of Bias tool for one or more of

the key domains (Higgins et al., 2011). An overview of all the moderators included in the meta-analysis can be found in Appendix 2.5.

Finally, information was also extracted on the BCTs present in both the intervention and control arms[10]. BCTs were coded based on the Behaviour Change Technique Taxonomy Version 1 (BCTTv1) developed by Michie et al., 2013 (see Appendix 2.6. for an overview of the taxonomy). Only BCTs that were present in the intervention and absent in the control condition were included in the moderator analysis. This approach was used to ensure that any difference in effect could be attributed to the inclusion of specific BCTs in any given intervention, as emphasised by Peters, de Bruin and Crutzen (2015), and used by MacDonald, Lorimer, Knussen and Flowers (2016) and Samdal, Eide, Barth, Williams and Meland (2017). Data on the presence of BCTs in each condition were extracted by two researchers. Only BCTs that identified by both researchers were coded as present.

2.2.5. Data Synthesis and Analysis

All summary effects and associated statistics were computed using Comprehensive Meta-Analysis (CMA) (Biostat, Englewood, NJ, USA; 2014). Effect size estimates were calculated based on the number of events screened per number of participants in a given study arm and pooled under the random effects model, with data expressed as odds ratios (ORs) with 95% confidence intervals (CIs) and Hedge's *g*. Due to the inclusion of a large and heterogeneous sample of studies in the meta-analysis, it was assumed *a priori* that the true effect size would differ between studies and therefore a random-effects meta-analysis was performed (rather than using a fixed-effects model, which assumes that all studies have the same true effect size). Where studies had more than one experimental groups compared with a single control condition, the number of participants in the control condition was evenly divided across the experimental conditions to ensure each participant was included only once in order to avoid double counting of participants in the meta-analysis.

Heterogeneity was assessed by formal statistical testing using two indicators; firstly, the *Q*-statistic, which is a measure of weighted squared deviations, and secondly, the I^2 statistic, which is a descriptive index that

[10] BCTs in the intervention arm were only coded if they were not present in the control arm in order to capture the differences in techniques used and their impact on intervention effectiveness

estimates the proportion of total observed variance attributable to between-study variation in effect size as opposed to random error. Assumptions of homogeneity were considered invalid when the *p*-value for the *Q*-test was $p < 0.05$. The more I^2 values deviate from zero the greater the justification for subsequent moderator analysis to explore the reasons of between-study variation. It is proposed that an I^2 value of 25%, 50% and 75% represents low, moderate and large study-to-study dispersion respectively, and therefore, greater heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003). Using procedures described by Borenstein, Hedges, Higgins and Rothsetain (2009), the impact of categorical moderator variables was assessed using subgroup analyses analogous to ANOVAs that partition the total effect size variance into variance within and between groups (Borenstein et al., 2009). Between group variance (Q_b) was used to test whether effect sizes differed among categories of a given moderator. For moderators with more than two levels, an overall Q_b was calculated, which, if statistically significant, was followed-up by multiple pairwise comparisons to further examine between group differences. The influence of continuous moderator variables was assessed using weighted regression analyses. Publication bias was assessed using two indices; firstly, publication bias was examined graphically using a funnel plot of effect sizes versus their standard errors to investigate the relationship between study sample size and study effect size, and secondly the trim and fill method, proposed by Duval and Tweedie (2000a, 2000b; see also Duval, 2005) (Duval, 2005; Duval & Tweedie, 2000a, 2000b) was used to estimate the number of studies missing from the meta-analysis due to the suppression of the most extreme results on one side of the funnel plot.

2.2.6. Additional Analyses

In order to assess whether any of the moderator variables were confounded, Pearson's correlation coefficient analysis was conducted. Specifically, the correlations between moderators were examined in order to determine any excessive overlap. Variables were considered to be confounded with one another if their shared variance exceeded 25% (i.e., $r > .50$). Categorical moderator variables were converted to dichotomies and entered into SPSS using the coding strategy outlined in Table 2.3.

Table 2. 3. Coding strategy to identify potential confounding variables.

Moderator	**Coding in SPSS**
Contact type	1 = In person/mixed contact, 0 = Remote contact
Intervention Delivery	1 = Individual delivery, 0 = Group/mixed delivery
Provider	1 = Delivered by a person (includes clinically and non-clinically trained health professionals and research staff), 0 = not delivered by a person
Materials	1 = Single technique (e.g., Phone, paper-based media) 0 = more than one techniques (e.g., paper-based media plus phone)
Setting	1 = Community setting, 0 = Primary care setting
Use of theory	1 = Extensive use of theory, 0 = Sparse/Moderate use of theory
Screening modality	1 = Non endoscopic screening (i.e., gFOBT/FIT), 0 = endoscopic screening (i.e., CS, FS)
Use of reminders	1 = Yes, 0 = No
Outcome assessment	1 = Objective, 0 = self-report
Risk of bias	1 = High/unclear bias, 0 = Low bias

2.3. Results

2.3.1. Study Selection

A total of 8,783 relevant articles were identified. After removal of duplicates, 6,650 remained and article titles and abstracts were screened against the predefined selection (i.e., inclusion/exclusion) criteria. Out of these 6,390 did not meet the inclusion criteria and therefore were excluded, resulting in 260 full-text articles to be assessed for eligibility. After independent review, 158 articles were excluded resulting into 102 articles containing 152 studies that were obtained for further analysis and coding. The PRISMA template was used to produce a flowchart outlining the exclusion and inclusion of studies at each stage of the selection process (See Figure 2.1).

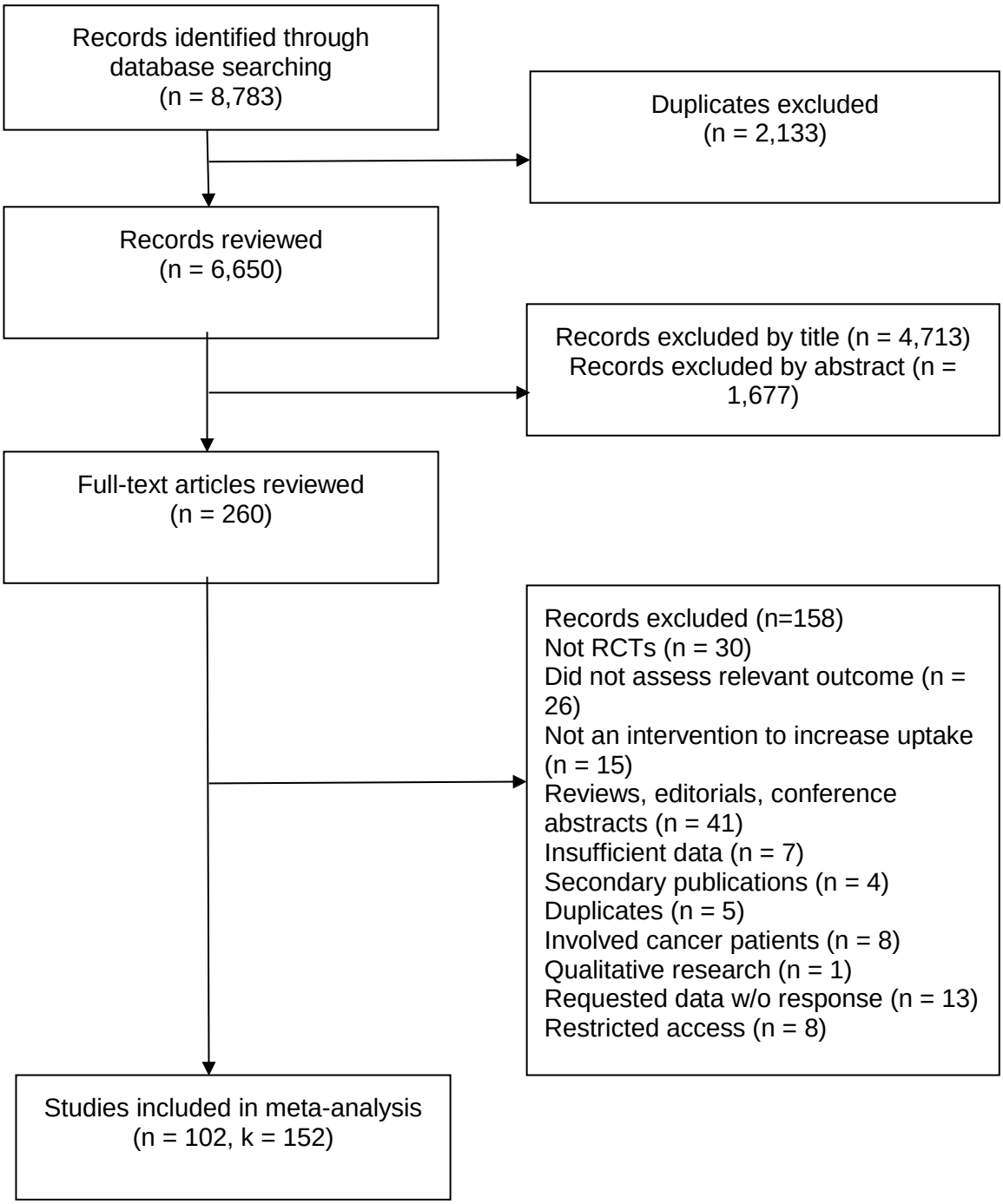

Figure 2. 1. PRISMA flow chart: schematic overview of the selection process for interventions eligible for full review.

2.3.2. Study Characteristics

A total of 102 published articles, incorporating 152 study comparisons[11], met study criteria and were coded accordingly, representing a cumulative *N* = 1,941,165 participants (median *N* per study = 1,220). A total of 919,037 participants were assigned to intervention and 1,022,128 to control arms. All of the studies were published between 2000 and 2016, with a median publication

[11] Thirty papers included several treatment arms and a single control arm. Each comparison of a treatment arm to a control arm was referred to here as a 'study comparison'.

year of 2012. The number of participants in each study ranged from 21 to over 250,000 participants, with a mean of 18,488 participants per study. The mean age of study participants was 61.3 years and ranged from 50 to 80 years. The majority of participants were female (59.1%). All but seven studies included both men and women; four studies recruited female participants only (*k* = 7, 4.6%) (Dietrich et al., 2006; Dietrich et al., 2007; Dietrich et al., 2013; Weinberg et al., 2013) and three studies recruited male participants only (Ferreira et al., 2005; Fitzgibbon et al., 2007; Ford et al., 2006). Seventy-six studies (77.5%) involved U.S. samples, one study was conducted in France (Barthe et al., 2015), one study in Poland (Boguradzka et al., 2014), three in Canada (Clouston et al., 2014; Ritvo et al., 2015; Tinmouth et al., 2014), three in Australia (Cole et al., 2007; Cole, Young, Byrne, Guy, & Morcom, 2002; Wilson et al., 2015), two in Spain (Gimeno-García, Quintero, Nicolás-Pérez, Parra-Blanco, & Jiménez-Sosa, 2009; Guiriguet et al., 2016), one in Italy (Rossi et al., 2011), three in Israel (Hagoel, Neter, Stein, & Rennert, 2016; Neter, Stein, Barnett-Griness, Rennert, & Hagoel, 2014; Vinker, Nakar, Rosenberg, & Kitai, 2002), 12 in the UK (Hewitson, Ward, Heneghan, Halloran, & Mant, 2011; Lo et al., 2014; McGregor et al., 2016; O'Carroll, Chambers, Brownlee, Libby, & Steele, 2015; Raine et al., 2016; Shankleman et al., 2014; Wardle et al., 2016[12]; Wardle et al., 2003; White et al., 2015), one in Iran , one in the Netherlands (van Roon et al., 2011) and one in Belgium (Van Roosbroeck, Hoeck, & Van Hal, 2012). For the *k* = 144 studies (94.7%)[13] that reported follow-up period this ranged from four weeks to three years, with a median follow-up period of 10 months. For the majority of studies (*k* = 119, 78.2%) screening uptake rates post-intervention were assessed objectively (e.g., accessing patient's medical records, health data derived from insurance plan claims) with only a small number of studies relying on self-report (*k* = 21, 13.8%). Apart from few studies (*k* = 10, 6.5%) that were restricted to endoscopic screening procedures alone (Boguradzka et al., 2014; Christie et al., 2008; Denberg et al., 2005; Ford et al., 2006; Jandorf et al., 2013; Ling et al., 2009; Wardle et al., 2003) most studies either involved non-endoscopic screening procedures (*k* = 56, 36.8%) or gave patients the option to choose between endoscopic and non-endoscopic screening (*k* = 86,

[12] The study by Wardle et al (2016) comprised of four separate cluster-randomised controlled trials and therefore these were treated as four separate studies in the meta-analysis.

[13] Six studies did not clearly report follow-up period (Horne et al., 2015; Jandorf et al., 2013; Krok-Schoen et al., 2015; Levy, Daly, Xu, & Ely, 2012; Lo, Good, et al., 2014; Van Roosbroeck et al., 2012).

56.5%). See Appendix 2.7 for a detailed overview of the characteristics of each study included in the meta-analytic review.

2.3.3. Risk of Bias

A composite score from all the studies for all the types reflecting risk of bias was calculated and a summary of the risk of bias assessment is shown in Figure 2.2.

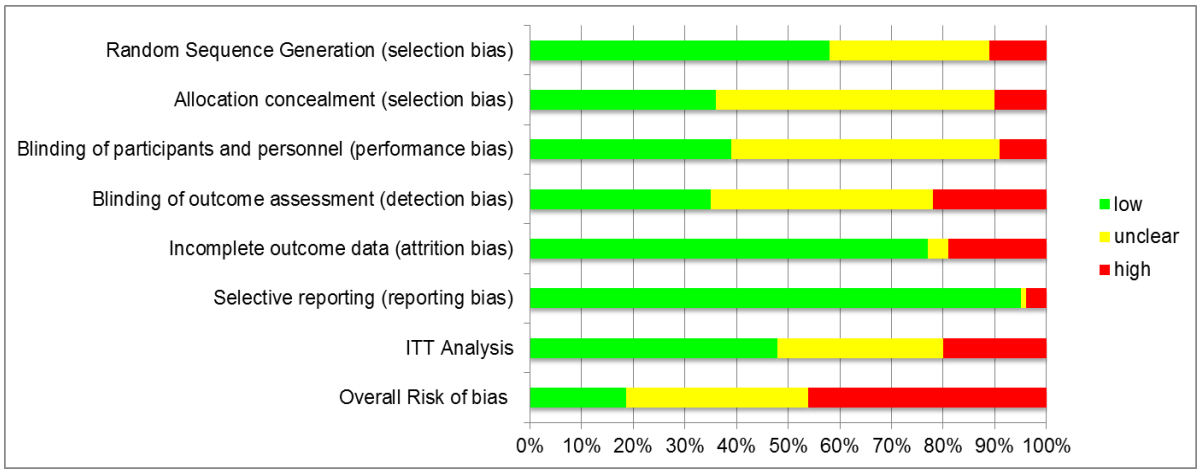

Figure 2. 2. Breakdown of each type of risk of bias identified in the included studies.

Less than a fifth of trials were graded as having low risk of bias (N = 19, 18.6%) across all areas assessed (Basch et al., 2006; Clouston et al., 2014; Denberg et al., 2005; Dietrich et al., 2006; Fortuna et al., 2014; Green et al., 2016; Green et al., 2013; Gupta et al., 2013; Hendren et al., 2014; Hewitson et al., 2011; Lee et al., 2009; McGregor et al., 2016; Miller, Kimberly, Case, & Wofford, 2005; O'Carroll, Chambers, Brownlee, Libby, & Steele, 2015; Phillips, Hendren, Humiston, Winters, & Fiscella, 2015; Pignone, Harris, & Kinsinger, 2000; Raine, Duffy, et al., 2016; Ruffin, Fetters, & Jimbo, 2007; Wardle et al., 2016).

Randomisation procedures were judged to place results at risk of selection bias in 11 studies (10.7%) (Blumenthal, Smith, Majett, & Alema-Mensah, 2010; Fiscella et al., 2011; Fitzgibbon et al., 2007; Ford et al., 2006; Ganz et al., 2005; Goldberg et al., 2004; Lewis, Brenner, Griffith, Moore, & Pignone, 2012; Menon et al., 2011; Pignone et al., 2011; Potter, Gildengorin, Wang, Wu, & Kroon, 2010; Potter et al., 2011), in a further 32 (31.3%) they were not described in sufficient detail and were judged as being unclear, and in 59 studies (57.8%) randomisation procedures were considered adequate and were

therefore judged as having low risk of bias. Ten studies (9.8%) were judged to be at high risk of bias for allocation concealment (Fiscella et al., 2011; Lewis et al., 2012; Menon et al., 2011; Percac-Lima et al., 2009; Potter et al., 2011; Salimzadeh, Eftekhar, Majdzadeh, Montazeri, & Delavari, 2014; Vernon et al., 2011; White et al., 2015; Wilson et al., 2015; Zapka et al., 2004). For nine studies (8.8%) blinding of participants and personnel was considered inadequate and therefore these studies were judged to be at high risk of performance bias (Krok-Schoen et al., 2015; Lewis et al., 2012; Menon et al., 2011; Potter et al., 2011; Price-Haywood, Harden-Barrios, & Cooper, 2014; Salimzadeh et al., 2014; Simon et al., 2010; Vernon et al., 2011; Wilson et al., 2015).

Twenty-two studies (21.5%) were judged as being at high risk for detection bias because outcome assessors were not considered to be adequately blinded (Blumenthal et al., 2010; Boguradzka et al., 2014; Braun et al., 2015; Church et al., 2004; Coronado, Golovaty, Longton, Levy, & Jimenez, 2011; Dignan et al., 2014; Ferreira et al., 2005; Ford et al., 2006; Goldberg et al., 2004; Horne et al., 2015; Hwang et al., 2013; Marcus et al., 2005; Maxwell et al., 2010; Maxwell, Danao, Cayetano, Crespi, & Bastani, 2016; Ornstein, Nemeth, Jenkins, & Nietert, 2010; Potter et al., 2010; Potter et al., 2011; Price-Haywood et al., 2014; Salimzadeh et al., 2014; Simon et al., 2010; Walsh et al., 2010; Zapka et al., 2004). Overall, 19 (18.6%) studies were judged to be at high risk of attrition bias because of participant drop-outs, (Braun, Fong, Kaanoi, Kamaka, & Gotay, 2005; Christie et al., 2008; Church et al., 2004; Cole et al., 2007; Dignan et al., 2014; Fitzgibbon et al., 2007; Ford et al., 2006; Horne et al., 2015; Jandorf et al., 2013; Jean-Jacques et al., 2012; Krok-Schoen et al., 2015; Levy et al., 2012; Lewis et al., 2012; Ling et al., 2009; Potter et al., 2010; Resnicow et al., 2014; Vinker et al., 2002; Walsh, Salazar, Terdiman, Gildengorin, & Pérez-Stable, 2005; White et al., 2015), however, one of these studies performed both per protocol and intention-to-treat analysis (Vinker et al., 2002), suggesting that the effect reported in these studies is not likely to be influenced by participant drop-outs during the follow-up. Four studies (3.9%) were judged to be at high risk of bias for selective reporting because they did not report some outcomes which authors had prespecified (Gimeno-García et al., 2009; Lo, Good, et al., 2014; Vinker et al., 2002; White et al., 2015). Twenty studies (19.6%) did not conduct intention-to-treat analysis and these were

judged as having high risk of bias (Baker et al., 2014; Boguradzka et al., 2014; Cole et al., 2007; Coronado et al., 2011; Dignan et al., 2014; Ford et al., 2006; Ganz et al., 2005; Jean-Jacques et al., 2012; Jensen et al., 2014; Lewis et al., 2012; Lo, Good, et al., 2014; Maxwell et al., 2016; McGregor et al., 2016; Menon et al., 2011; Mosen et al., 2010; Price-Haywood et al., 2014; Resnicow et al., 2014; Salimzadeh et al., 2014; van Roon et al., 2011; White et al., 2015). See Appendix 2.8 for a detailed overview of the risk of bias assessment for each study across all domains.

2.3.4. Syntheses of Results

2.3.4.1. Overall effect of health interventions on bowel cancer screening uptake

Across 102 articles (k = 152) results revealed that health interventions led to significantly higher CRC screening uptake rates than did comparison/control conditions, g = .221, OR = 1.493, 95% CI: 1.428, 1.561, p < .001 (See Appendix 2.9 for forest plot comparing interventions in the full sample, low SES and non-low SES subgroups). This composite effect size represents a small, yet statistically significant result, favouring the intervention group over the control group. Specifically, participants that had been exposed to the intervention had a screening uptake rate that was 1.25% higher compared to the control group, which translates into 24,265 more people being screening as a direct result of the intervention.

Given the focus of the present meta-analysis to identify which strategies were more effective in increasing screening uptake among deprived populations, a subset analysis was conducted by grouping studies by level of socioeconomic status (SES). As mentioned earlier, studies were deemed as involving *low SES* populations in respect of: (1) poverty/SES status; (2) ethnic minority status; (3) education/literacy level; (4) geographical location – that is, areas described as disadvantaged or medically underserved. Studies that did not report including any of the aforementioned groups were classified as *non-low SES.*

2.3.4.2. Effect of health interventions on CRC screening uptake by level of SES

Results from the subset analysis indicated that for the group of studies in *low SES* populations, health interventions were significantly more effective compared to the *non-low SES* group of studies; g = .403, OR = 2.080, 95% CI:

1.745, 2.478, $p < 0.001$ (See Appendix 2.10 for forest plot) and $g = .174$, OR = 1.372, 95% CI: 1.310, 1.438, $p < 0.001$ (See Appendix 2.11 for forest plot) respectively, and this difference in effect between the two SES groups was statistically significant (Q_b: 37.896, *df* = 1, $p<.001$). Notably, this statistically significant effect observed in the *low SES* studies, translated into a 12.6% increase in screening uptake, compared to a 1.00% increase in screening uptake for the *non-low SES* studies, and a 1.25% increase in screening uptake in the full sample of studies (see Figure 2.3).

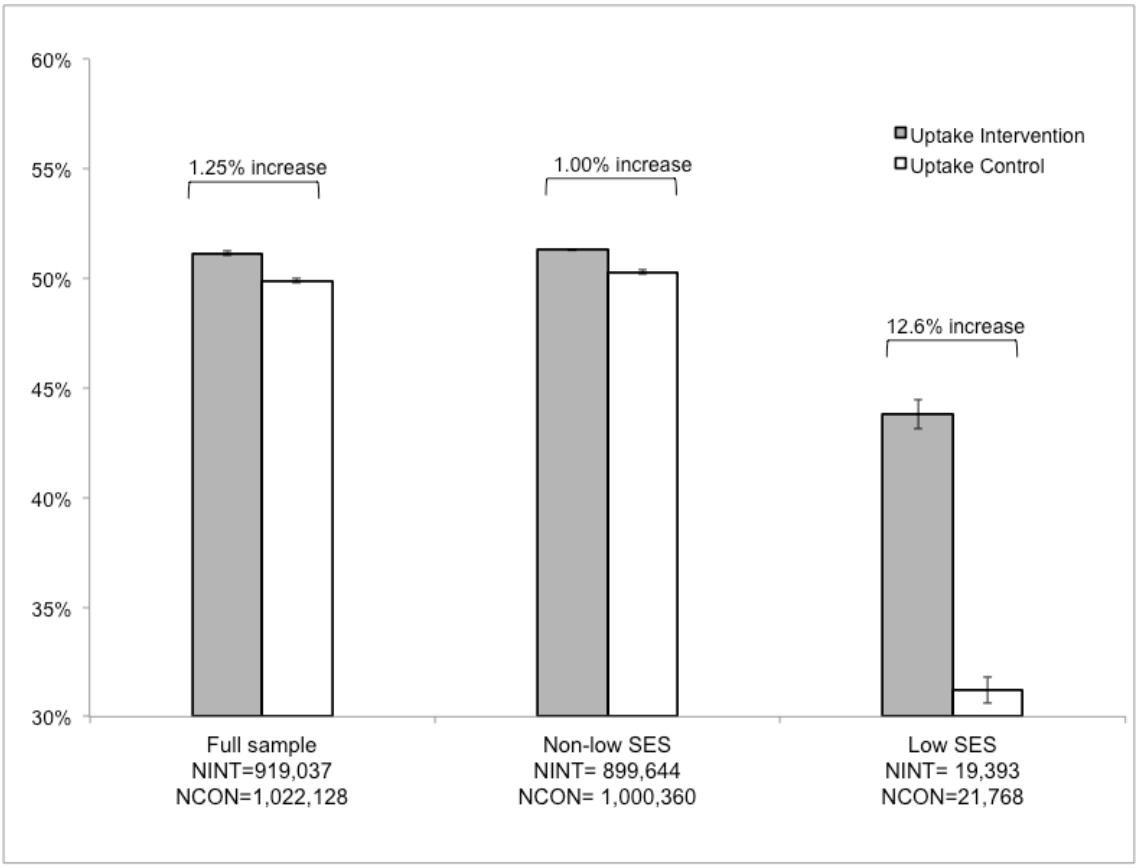

Figure 2. 3. Screening uptake (%) by study condition and SES group.

Despite the substantial increase observed in the studies involving more deprived populations, screening uptake in the intervention condition of the *low SES* group was still lower compared to screening uptake in the control condition of the *non-low SES* group (43.81% versus 50.29% respectively, absolute difference: 6.48%). An independent samples t-test was conducted to compare screening uptake between the two groups; results indicated that, despite the substantial increase in screening uptake, screening rates were significantly lower in the *low SES* intervention group compared to the *non-low SES* control group ($t(150)= 2.590$, $p = .011$). The 95% CIs for proportions were also calculated for

these two groups to further examine whether these were significantly different (See Appendix 2.12 for calculation of 95% CIs). Results indicated that the confidence intervals for the *non-low SES* control group (0.502, 0.503) and the *low SES* intervention group (0.431, 0.444) did not overlap. Therefore, it was concluded that there is a statistically significant difference in the two population values at the given level of confidence. Specifically, it was concluded that screening uptake was significantly higher for people in the *non-low SES* control group compared to people in the *low SES* intervention group.

Overall, results indicated that health interventions were substantially more beneficial for the more vulnerable populations and as a result there was a substantial increase in screening uptake rates. Nonetheless, it is worrying that uptake rates remained suboptimal and significantly lower for the *low SES* groups compared to the *non-low SES* groups.

2.3.4.3. Moderator analyses

Subgroup analyses were conducted to determine the influence of all categorical moderators on intervention effectiveness. For non-categorical variables weighted meta-regression analyses were conducted. In terms of contact type (i.e., moderator one in Table 2.4 below), results showed that mixed interventions that were delivered to *low SES* populations yielded the greatest increase in screening uptake (g = .744, OR = 3.863, 95% CI: 2.105, 7.008, p < .001) and remote interventions delivered to a *non-low SES* populations resulted in the smallest increase in screening uptake (g = .164, OR = 1.347, 95% CI: 1.280, 1.417, p<.001). The Q-test analogous to the ANOVA test revealed that the overall difference among intervention contact types and SES populations was significant (Q_b (5) = 56.535, p < 0.001). Follow-up pairwise comparisons indicated that only two comparisons were statistically significant. Interventions that were not delivered in person yielded significantly greater screening uptake rates for the *low SES* group compared to the *non-low SES* group (Q_b (1) =32.643, p<0.001); and that mixed interventions – that is, those that combined aspects that were delivered both in person and remotely – were significantly more effective among the *low SES* populations compared to studies that were delivered remotely among *non-low SES* populations (Q_b (1) = 4.429, p = .035).

In terms of intervention delivery (i.e., moderator two in Table 2.4 below) results revealed that interventions that were delivered on an individual basis

(i.e., one-to-one) among *low SES* populations yielded the greatest increase in screening uptake (*g* = .414, OR = 2.123, 95% CIs, 1.738, 2.593, *p*<.001) and group and/or mixed interventions delivered to *non-low SES* populations resulted in the smallest - and non-significant - increase in screening uptake (*g* = .068, OR = 1.131, 95% CI: 0.957, 1.336, *p* = .149). The Q-test revealed that the four groups significantly differed from one another in terms of overall effect size (Q_b (3) = 43.505, *p* < 0.001). Follow-up pairwise comparisons indicated that several differences were significant. In particular, interventions delivered on an individual basis to a *low SES* population were significantly more effective compared to similar interventions (Q_b (1) = 31.530, *p* < .001) and group or mixed interventions delivered to a *non-low SES* group (Q_b (1) = 17.95, *p* < .001). Interventions delivered within a group were also significantly more effective for the *low SES* group when compared to the equivalent interventions delivered to the *non-low SES* group (Q_b (1) = *7.874*, *p* = 0.005) and these were also significantly more effective compared to the one-to-one interventions delivered to the less deprived group (Q_b (1) = 10.32, *p* = 0.001).

In terms of intervention provider (i.e., moderator three in Table 2.4 below) results indicated that interventions that did not involve an element of interaction between providers and participants, yielded the smallest study effect sizes for both the *low SES* and *non-low SES* groups (*g* = 0.295, OR = 1.709, 95% CI: 1.248, 2.339, *p* = 0.001 and *g* = 0.130, OR = 1.265, 95% CI: 1.202, 1.332, *p* < .001 respectively), suggesting that the provider's involvement in the delivery of the intervention may be particularly important within the context of CRC screening. The largest effect sizes for this moderator were observed among the *low SES* studies and particularly for interventions that were delivered by clinically-trained healthcare professionals (*g* = 0.643, OR = 3.215, 95% CI: 2.045, 5.054, *p* < .001) or research staff (*g* = 0.657, OR = 3.303, 95% CI: 1.892, 5.766, *p* < .001). The Q-test revealed that the eight groups significantly differed from one another in terms of overall effect size (Q_b (7) = 155.78, *p* < .001). Follow-up pairwise comparisons indicated that interventions that were delivered by non-clinically trained healthcare providers (e.g. community health educators) were significantly more effective in increasing screening uptake compared to interventions that were not person dependent, for both the *low SES* populations (Q_b (1) = 4.887, *p* = 0.027) and the *non-low SES* populations (Q_b (1) =20.00, *p* < .001). In agreement to this finding, interventions that were not delivered by a

person - rather they solely relied on other modes of delivery, such as educational brochures - appeared to be significantly less effective for the *non-low SES* populations when compared to interventions delivered to *low SES* populations by both clinically and non-clinically trained health professionals (Q_b (1) = 6.219, p = 0.013 and Q_b (1) =18.34, p < .001, respectively), indicating that less deprived populations benefit less from interventions that do not involve an interaction between the intervention provider and the intervention recipient. When research staff delivered the intervention, the effect size was significantly greater compared to interventions that were not delivered by a person for both the *low SES* and *non-low SES* populations (all pairwise comparisons p < .05).

In terms of whether certain intervention materials (i.e., moderator four in Table 2.4 below) were more useful than others in increasing screening uptake, results indicated that this variable modified overall effect size (Q_b (11) = 107.327, p < .001). Follow-up pairwise comparisons indicated that several differences were statistically significant. Specifically, interventions delivered to *non-low SES* populations and that involved the use of electronic media, were significantly less effective compared to interventions delivered to the same group but that used paper-based media (e.g., brochures, leaflets etc.), paper-based media and/or phone calls, and those that were delivered in person rather than involving the use of any of the aforementioned media (p < .05 for all pairwise comparisons). Similarly, these interventions were also significantly less effective compared to the equivalent interventions that involved electronic media, paper-based interventions and phone interventions delivered among *low SES* populations (p < .05 for all pairwise comparisons). These results suggest that incorporating electronic media in interventions delivered to less deprived groups is not particularly effective in increasing screening uptake for this population. Conversely, for the *low SES* group interventions that did make use of electronic media seemed to be significantly more effective compared to those delivered in person within the same SES level (Q_b (1) = 5.889, p = 0.015) and also compared to those that used paper-based media among the *non-low SES* groups (Q_b (1) = 10.69, p < .001). It is worth noting however, that few studies incorporated electronic media for interventions delivered to *low SES* populations (k = 3), therefore not allowing meaningful inferences to be made regarding the value of this approach in increasing screening uptake among people within this demographic. Lastly, the use of paper-based media among

the *non-low SES* studies did not seem to be particularly useful in increasing this population's screening uptake rates, as the effect size was significantly smaller than similar studies in the *low SES* group, paper based plus telephone studies in both the *low* and *non-low SES* groups and studies delivered in person to the *non-low SES* groups ($p < .05$ for all pairwise comparisons). Notably, studies delivered to *non-low SES* populations that included both paper-based materials alongside phone calls were substantially more effective than those that just used paper-based materials ($g = .442$ and $g = .150$ respectively) and this difference in effect was statistically significant (Q_b (1) = 7.777, $p = 0.005$). Interestingly, the intervention materials that were associated with the greatest effect sizes, for both the *non-low SES* group and the *low SES* group[14], were observed for interventions that incorporated a paper-based element alongside a phone call ($g = 0.442$ and $g = 0.474$). These findings suggest that incorporating a phone call alongside standard, paper-based invitations and brochures might be particularly useful for increasing CRC screening uptake irrespective of SES.

With regard to the setting in which interventions took place (i.e., moderator five in Table 2.4 below), results revealed greater effect sizes for community settings versus primary care settings for both *low* and *non-low SES* populations ($g = .485$ and $g = .197$ respectively). Results from the Q-test indicated that there were significant differences in overall effect size between the four groups within this moderator (Q_b (3) = 44.497, $p < 0.001$). Follow-up pairwise comparisons revealed that, for the *low SES* populations, interventions delivered in a community setting had a greater effect on screening uptake compared to those delivered in both primary care and community settings to *non-low SES* populations (Q_b (1) = 16.24, $p < .001$ and Q_b (1) = 6.389, $p = 0.011$ respectively). Interventions delivered in primary care were more effective for the *low SES* populations compared to interventions delivered to *non-low SES* populations in a similar setting (Q_b (1) = 22.813, $p < 0.001$).

The level of reported use of theory (i.e., moderator six in Table 2.4 below) was also a significant moderator of overall effect size (Q_b (3) = 23.15, $p < 0.001$). Specifically, sparse to moderate reported use of theory was more effective than extensive use of theory for the *non-low SES* studies (Q_b (1) = 17.41, $p < .001$). Extensive use of theory was significantly more effective for *low*

[14] For this group the greatest effect size was observed for electronic media plus paper-based media (g=0.779), however, due to the small sample size (k=3) the second greatest effect size was considered for this comparison.

SES populations compared to similar studies conducted among *non-low SES* populations (Q_b (1) = 4.577, p = .032).

With regards to the type of screening modality used (i.e. endoscopic, non-endoscopic or having the choice of either of these; moderator seven in Table 2.4 below), the greatest effect size observed, across the two SES groups and screening modalities, was that reported for non-endoscopic screening among *low SES* studies (g =.701, OR = 3.577, 95% CI: 2.415, 5.297, p < .001). Contrastingly, the lowest effect size was reported for interventions using endoscopic screening procedures among *low SES* studies (g = .045, OR = 1.082, 95% CI: 0.584, 2.006, p = .802). Results from the Q-test indicated that the type of screening modality was a moderator of overall effect size (Q_b (5) = 114.880, p < .001). Follow-up pairwise comparisons indicated that a number of comparisons were significantly different. Among the *non-low SES* studies, interventions that involved endoscopic CRC screening procedures (e.g., colonoscopy) resulted in a significantly greater effect size compared to studies involving stool-based screening tests (Q_b (1) = 4.648, p = .031). Within the sample of *low SES* studies however, a reverse pattern of findings was observed; that is - interventions that involved stool-based tests as their selected screening modality generated a significantly greater effect size compared to those that used endoscopic screening, indicating that the greater level of invasiveness that these tests present with, might be a deterring factor from screening for more deprived participants (Q_b (1) = 24.26, p < .001). Study effect size remained significantly higher for non-endoscopic screening procedures among the *low SES* studies, even when compared to interventions where participants had the option of choosing their preferred screening method, and this was the case among both *low SES* populations (Q_b (1) = 7.134, p = .008) and *non-low SES* populations (Q_b (1) = 14.34, p < .001). Contrastingly, non-endoscopic screening procedures (i.e., stool-based tests) for the *non-low SES* studies were significantly less effective compared to interventions that gave participants the option to choose their preferred screening method, and this was observed when compared to both *non-low SES* (Q_b (1) = 30.78, p < .001) and *low SES* groups (Q_b (1) = 18.18, p < .001). Comparisons between the two SES groups indicated that non endoscopic screening procedures (e.g., FIT, gFOBT) were significantly more effective for the *low SES* groups compared to the *non-low SES* groups (Q_b (1) = 22.813, p < .001), and that endoscopic screening

procedures were significantly more effective in increasing uptake for the *non-low SES* studies compared to the *low SES* studies (Q_b (1) = 5.088, p = .024), showcasing the exact opposite pattern of findings between the two SES groups.

The use or reminders (i.e., prompt/cues to obtain screening) was included in the moderator analyses separate from other behaviour change techniques because of the frequency to which interventions incorporated them as an integral aspect of the study (i.e., moderator eight in Table 2.4 below). Results indicated that this BCT significantly moderated the overall effect size (Q_b (3) =, 45.578, p < .001). Overall, the greatest effect size, across the levels of this moderator and across SES groups, was observed for studies that used reminders and that were targeted at more deprived populations (g = .453, OR = 2.276, 95% CI: 1.798, 2.882, p < .001), whereas the lowest effect size was observed among studies that did not use reminders among *non-low SES* studies (g = .144, OR = 1.298, 95% CI: 1.216, 1.386, p < .001), highlighting the overall usefulness of interventions incorporating prompts and cues, irrespective of SES level. Follow-up pairwise comparisons indicated that four comparisons were statistically significant. Specifically, the use of reminders in studies targeting *low SES* populations resulted in a significantly greater effect size when compared to similar studies targeting *non-low SES* populations (Q_b (1) = 23.801, p < .001). Within the *non-low SES* studies, interventions that used reminders were significantly more effective that those who did not (Q_b (1) = 5.220, p = .022). Interventions that did not use reminders in the *non-low SES* group were significantly less effective compared to both studies that used and did not use reminders in the *low SES* group (Q_b (1) = 19.25, p <.001 and Q_b (1) = 9.301, p = .002).

The strategy by which authors assessed screening uptake (i.e., moderator nine in Table 2.4 below) was also a significant moderator of the overall effect size (Q_b (3) = 45.819, p < .001). Follow-up pairwise comparisons showed that only two comparisons were significantly different; firstly, results indicated a significantly larger effect in uptake for *low SES* studies when this was assessed objectively (e.g., through electronic medical records) compared to *non-low SES* studies which also assessed screening uptake objectively (Q_b (1) = 22.99, p < .001). Secondly, within the *low SES* studies a similar finding was observed; studies that assessed screening uptake objectively resulted in greater effect sizes compared to studies targeting the same demographic but

that assessed screening rates through self-report (Q_b (1) = 4.638, p = .031). These findings are particularly promising as they indicate that the greater effect size observed among more deprived populations is not attributed to this particular bias in methodology.

Similarly, the risk of bias (i.e., moderator ten in Table 2.4 below) evident within studies was another variable that significantly moderated overall effect size (Q_b (5) = 96.683, p < .001). Overall, across all levels of the moderator and across SES groups, the greatest effect size was observed among studies with low risk of bias delivered to *low SES* populations (g = .551, OR = 2.719, 95% CI: 1.864, 3.967, p < .001) and the smallest effect size was reported for studies with a high risk of bias delivered *to non-low SES* populations (g = .115, OR = 1.232, 95% CI: 1.156, 1.314, p < .001). Follow-up pairwise comparisons showed that studies that had low risk of bias, and that targeted *low SES* populations, were significantly more effective than studies with high bias that targeted *non-low SES* populations (Q_b (1) = 12.86, p < .001) and also than studies with unclear bias or low bias among *non-low SES* populations (Q_b (1) = 6.557, p = .010 and Q_b (1) = 12.38, p <.001 respectively). Results of the subgroup analyses can be found in Table 2.4 below.

Table 2. 4. Summary of meta-analysis results for non-low SES versus low SES[a] studies (k =105 and k = 47 respectively).

	Sample									
	Non-low SES					Low SES[a]				
Analysis		**Random-effects model**	**Sig.**	**Heterogeneity**	**Within subgroup differences**		**Random-effects model**	**Sig.**	**Heterogeneity**	**Within subgroup differences**	**Overall between group effect**
	k	**g, OR (95% CI)**	***p***	**Q, P*h*, I^2 (%)**	**(Q_b, df, *p*)**	***k***	**g, OR (95% CI)**	***p***	**Q, P*h*, I^2 (%)**	**(Q_b, df, *p*)**	**(Q_b, df, *p*)**
Overall effect	**105**	**0·174, 1·372 (1·310-1·438)**	p<0·001	**3179·00 p<0·001, 96·7%**	**-**	**47**	**0·403, 2·080 (1·745-2·478)**	***p*<0·001**	**508·01, p<0·001, 90·9%**	**-**	**37·896[b], 1, p<0·001**
INTERVENTION CHARACTERISTICS											
Moderator 1: Contact type											56·535, 5, *p*<0·001
Face-to-face	6	0·216, 1·478 (1·221-1·790)	*p*<0·001	92·48, p<0·001, 94·5%	4·545, 2, *p* = 0·103	11	0·282, 1·669 (1·144-2·435)	*p* = 0·008	49·40, *p*<0·001, 79·7%	5·297, 2, *p* = 0·071	
Remote	89	0·164, 1·347 (1·280-1·417)	*p*<0·001	2899·00, p<0·001, 96·9%		32	0·401, 2·071 (1·673-2·562)	*p*<0·001	358·2, *p*<0·001, 91·3%		
Mixed	10	0·261, 1·608 (1·360-1·900)	*p*<0·001	155·8, p<0·001, 94·2%		4	0·744, 3·863 (2·105-7·008)	*p*<0·001	56·98, *p*<0·001, 94·7%		
Moderator 2: Delivery											43·505, 3, *p*<0·001
Individual (i.e., one-to-one)	98	0·184, 1·397 (1·330-1·467)	*p*<0·001	3150·00, p<0·001,	5·702, 1, *p* = 0·017	39	0·414, 2·123 (1·738-2·593)	*p*<0·001	407·2, *p*<0·001, 90·6%	0·151, 1, *p* = 0·698	

				96·9%							
Group/Mixed	7	0·068, 1·131 (0·957-1·336)	*p* = 0·149	27·00, p<0·001, 77·7%		8	0·363, 1·934 (1·268-2·950)	*p* = 0·002	89·35, *p*<0·001, 92·1%		
Moderator 3: Provider[c]											155·78, 7, *p*<0·001
Clinically-trained health professionals	3	0·426, 2·172 (1·551-3·043)	*p*<0·001	35·49, *p*<0·001, 94·3%	65·773, 3, *p*<0·001	4	0·643, 3·215 (2.045-5.054)	*P*<0·001	122·1, *p*<0.001, 97·5%	7.958, 3, *p* = 0.047[d]	
Non-clinically trained health professionals	8	0·469, 2·342 (2·012-2·727)	*p*<0·001	99·88, *p*<0·001, 92·9%		27	0·374, 1·973 (1·603—2·427)	*p*<0·001	136·3, *p*<0.001, 80·9%		
Research staff	11	0·229, 1·516 (1·294-1·776)	*p*<0·001	109·2, *p*<0·001, 90·8%		4	0·657, 3·303 (1·892-5·766)	*p*<0·001	923·00, *p*=0·026, 67·4%		
Not person dependent	77	0·130, 1·265 (1·202-1·332)	*p*<0·001	2519·00, *p*<0·001, 96·9%		11	0·295, 1·709 (1·248-2·339)	*p* = 0·001	47·08, *p*<0·001, 78·7%		
Moderator 4: Materials[e]											107·327, 11, *p*<0·001
Electronic and paper-based media	26	0·082, 1·161 (1.057-1.273)	*p* = 0·002	198·7, *p*<0·001, 87·4%	42·392, 5, *p*<0·001	3	0·779, 4·138 (1·891-9·052)	*p*<0·001	4·648, *p* = 0·098, 56·9%	6·043, 5, *p*=0·302	
Paper-based media only	50	0·150, 1·312 (1.237-1.392)	*p*<0·001	1857·00, *p*<0·001, 97·3%		11	0·383, 2·006 (1·351-2·979)	*p*<0·001	93·62, *p*<0·001, 89·3%		
Paper-based and phone	10	0·442, 2·232 (1·851-2·691)	*p*<0·001	59·40, *p*<0·001, 84·8%		15	0·474, 2·365 (1·718-3·257)	*p*<0·001	195·46, *p*<0·001, 92·8%		
Phone	5	0·222, 1·495 (1·237-1·807)	*P*<0·001	147·0, *p*<0·001,		7	0·332, 1·830 (1·116-3·001)	*p* = 0·017	20·68, *p* = 0·002, 70·9%		

				97·2%							
In-person delivery	8	0·226, 1·508 (1·295-1·755)	*p*<0·001	112·9, *p*<0·001, 93·7%		5	0·164, 1·345, (0.757-2.392)	*p* = 0·312	28·99, *p*<0·001, 86·2%		
Paper-based media and in person delivery	3	0·099, 1·197 (0·894-1·603)	*p* = 0·227	7·838, *p* = 0·020, 74·4%		6	0·386, 2·014 (1·236-3·282)	*p* = 0·005	96·13, *p*<0·001, 94·8%		
Moderator 5: Setting[f]											44·497, 3, *p*<0·001
Community	20	0·197, 1·431 (1·282-1·597)	*p*<0·001	380·9, *p*<0·001, 95.0%	0·836, 1, *p* = 0·361	22	0·485, 2·416 (1·844-3·166)	*p*<0·001	153·2, *p*<0·001, 86·2%	2·040, 1, *p* = 0·153	
Primary care	82	0·167, 1·353 (1·290-1·418)	*p*<0·001	2005·9, *p*<0·001, 95·9%		25	0·341, 1·859 (1·467-2·356)	*p*<0·001	350·1, *p*<0·001, 93·1%		
Moderator 6: Use of Theory											
Sparse/Moderate	29	0·132, 1·328 (1·160-1·521)	*p*<0·001	144·9, *p*<0·001, 80.6%	17.41, 1, *p* < 0·01	5	0.149, 1.311, (0.869-1.978)	p=0.197	24.75, *p*<0.001, 83.7%	0.0150, 1, *p*=0.903	
High	4	-0·006, 0·989 (0·961-1·017)	*P*=0·440	1·826, *p*=0·609, 0%		6	0.133, 1.273 (1.012-1.601)	p=0.039	7.537, *p* = 0.184, 33.6%		
Moderator 7: Screening modality											114·880, 5, *p*<0·001
Endoscopic	5	0·475, 2·373 (1·818-3·098)	*p*<0·001	25·73, *p*<0·001, 84·4%	50·52, 2, *p*<0·001	5	0·045, 1·082 (0.584-2.006)	*p* = 0·802	4·77, *p*=0·11, 16·2%	12·112, 2, *p* = 0·002	

Non-endoscopic	46	0·097, 1·193 (1.126-1.264)	*p*<0·001	1592·00, *p*<0·001, 97·1%		10	0·701, 3·577 (2.415-5.297)	*p*<0·001	179·6, *p*<0·001, 94·9%		
Either	54	0·237, 1·538 (1·442-1·640)	*p*<0·001	740·1, *p*<0·001, 92·8%		32	0·359, 1·921 (1·544-2·388)	*p*<0·001	275·9, *p*<0·001, 88·7%		
Moderator 8: Use of reminders											47·578, 3, *p*<0·001
Reminders	47	0·217, 1·483 (1·380-1·594)	*p*<0·001	1438·00, *p*<0·001, 96·8%	7·231, 1, *p* = 0·007	27	0·453, 2·276 (1.798-2.882)	*p*<0·001	328·2, *p*<0·001, 92%	1·255, 1, *p* = 0·263	
No reminders	58	0·144, 1·298 (1·216-1·386)	*p*<0·001	1735·00, *p*<0·001, 96·7%		20	0·339, 1·853 (1·412-2·431)	*p*<0·001	165·4, *p*<0·001, 88·5%		
METHODOLOGICAL CHARACTERISTICS											
Moderator 9: Outcome assessment[g]											45·819, 3, *p*<0·001
Objective	84	0·176, 1·376 (1.306-1.449)	*p*<0·001	3021·00, *p*<0·001, 97·2%	3·812, 1, *p* = 0·051	35	0·463, 2·319 (1·894-2·839)	*p*<0·001	477·5, *p*<0·001, 92·8%	1·753, 1, *p* = 0·186[h]	
Self-report	12	0·270, 1·633 (1.386-1.923)	*p*<0·001	96·10, *p*<0·001, 88·5%		9	0·289, 1·692 (1·110-2·579)	*p* = 0·015	15·91, *p*=0·044, 49·7%		
Moderator 10: Risk of bias											96·683, 5, *p*<0·001

High bias	42	0·115, 1·232 (1·156-1·314)	*p*<0·001	352·1, *p*<0·001, 88·3%	13·904, 2, *p*<0·001	27	0·310, 1·755 (1·409-2·187)	*p*<0·001	119·5, *p*<0·001, 78·2%	4·663, 2, *p* = 0·097
Unclear bias	40	0·212, 1·469 (1.374-1.571)	*p*<0·001	954·8, *p*<0·001, 95·9%		12	0·459, 2·301 (1·718-3·082)	*p*<0·001	164·9, *p*<0·001, 93·3%	
Low bias	23	0·167, 1·354 (1·253-1·463)	*p*<0·001	602·9, *p*<0·001, 96·3%		8	0·551, 2·719 (1·864-3·967)	*p*<0·001	73·14, *p*<0·001, 90·4%	

Notes. k = number of comparisons, *g* = Hedge's g measure of effect size, OR = odds ratio, CI = confidence interval, P*h*=p value of Q test for heterogeneity test, Q_b = Q value indicating the between-group effect. [a]Studies were determined as having a 'low SES' sample in respect of: (1) Poverty/SES status; (2) Ethnic minority status; (3) Education/literacy; (4) Geographical location (areas described as disadvantaged/medically underserved) and was categorised into 'low SES' or 'non-low SES' according to author-set criteria. [b]Q_b value reported from subgroup analysis conducted across k=152 but the effect sizes reported in the table are taken from individual sensitivity analyses for non-low and low SES studies. [c]Three papers were not included in the analysis (Groups 1 and 2 from Church et al 2004; Groups 1, 2 and 3 from Marcus et al, 2005; Walsh et al, 2005) as it was unclear, or not reported, who delivered the intervention. [d]One paper was not included in the analysis (Price-Haywood et al., 2014) as it was unclear who delivered the intervention. [e]Three papers were not included in the analysis (Cameron et al, 2011; Clouston et al 2014; Group 3 from Green et al, 2013) as they did not meet inclusion criteria for any of the moderator categories. [f]Two papers not included in the analysis (Krok-Schoen et al, 2015; Groups 3 and 4 from White et al, 2015) as they did not meet inclusion criteria for any of the moderator categories. [g]Five papers not included in the analysis (Barthe et al., 2015; Clouston et al., 2014; Groups 1, 2 and 3 from Cole et al., 2002; Groups 1, 2 and 3 from Cole et al., 2007; Guiriguet et al., 2016) as it was either unclear or not reported how screening uptake was assessed. [h]Two papers not included in the analysis (Ford et al., 2006; Groups 1 and 2 from Jandorf et al., 2013) as it was either unclear or not reported how screening uptake was assessed.

The weighted meta-regressions with each continuous moderator as the independent variable revealed that for the *non-low SES* studies, only age composition of the sample and screening status at time of study (defined as the percentage of participants up-to-date with screening at the start of the research) had a moderating influence on effect size (β = -.022, Z = -2.64 , p = .008 and β = -.012, Z = -2.853 , p = .004). Studies with older participants in the sample showed a smaller increase in screening uptake rates, as did studies with more participants up-to-date with screening at baseline. For the *low SES* studies none of the continuous variables were significant moderators of overall study effect size (see Table 2.5.)

Table 2. 5. Continuous variables meta-regressed[a] on screening uptake by level of SES.

	Non-low SES							Low SES					
				95% CI							95% CI		
Predictor	***k***	**Q-test**	**Beta**	**Lower limit**	**Upper limit**	**Z**	***P***	***k***	**Q-test**	**Beta**	**Lowe limit**	**Upper limit**	***Z***	***P***
Age (mean)	97	6·994**	-0·022**	-0·038	-0·005	-2·644	0·008**	43	0·045	0·004	-0·040	0·050	0·213	0·83
Gender (%males)	93	0·309	-0·001	-0·004	0·002	-0·556	0·57	46	0·699	-0·003	-0·010	-0·004	-0·836	0·40
Family history (%yes)	20	0·672	0·014	-0·019	0·048	0·820	0·41	20	0·322	0·010	-0·026	0·047	0·568	0·56
Screening status at time of study (%yes)	36	8·142**	-0·012**	-0·020	-0·003	-2·853	0·004**	24	0·471	-0·004	-0·016	0·007	-0·686	0·49

Notes. *k* = number of comparisons, CI = confidence interval, BCTs = behaviour change techniques. *p<0·05, **p<0·01. [a]Meta-regression analysis was applied only if the pooled cohorts exceeded k = 10.

2.3.4.3.1.1. Moderator analyses: Behaviour Change Techniques (BCTs)

Overall 39 out of the 93 BCTs in the BCTTc1 taxonomy were identified as being employed in the studies reviewed. The median N of BCTs used in interventions was N = 3 and the range of BCTs used across the included studies was between 1 and 10 techniques. Individual BCTs were included as moderators in the analysis if they were coded for at least *k* = 10 studies. The five most commonly reported BCTs were 'Information about health consequences', 'Prompts/cues', 'Social Support (practical)', Adding Objects to the Environment'[15] and 'Problem Solving'. The five least commonly reported BCTs were 'Imaginary Punishment', 'Non-specific Incentive', 'Specific Incentive', 'Social Incentive' and 'Information about Social and Environmental Consequences'. An overview of the frequencies of the 39 BCTs used in the 102 studies reviewed, ranked by the most frequently applied techniques, can be seen in Figure 2.4. BCTs were also organised in terms of their 16 overarching groupings and an overview of these groupings alongside the frequencies of each BCT within each grouping can be found in Figure 2.5.

[15] This BCT was coded only for U.S.-based studies that sent a stool-based screening kit for free irrespective of participants' insurance status. This BCT was not coded for countries with universal healthcare.

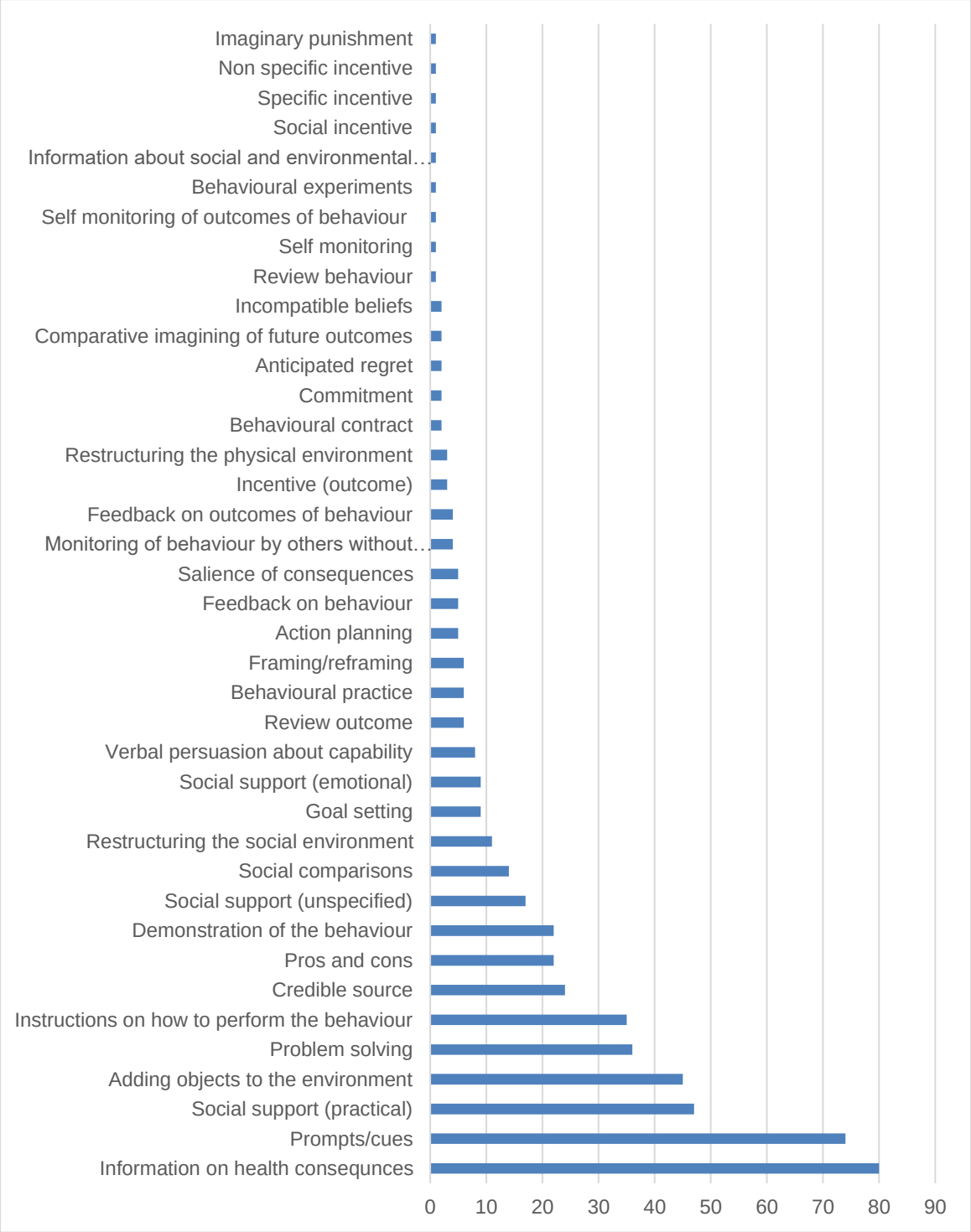

Figure 2. 4. Frequencies of the 39 behaviour change techniques used in the 102 studies reviewed and ranked by the most frequently applied techniques

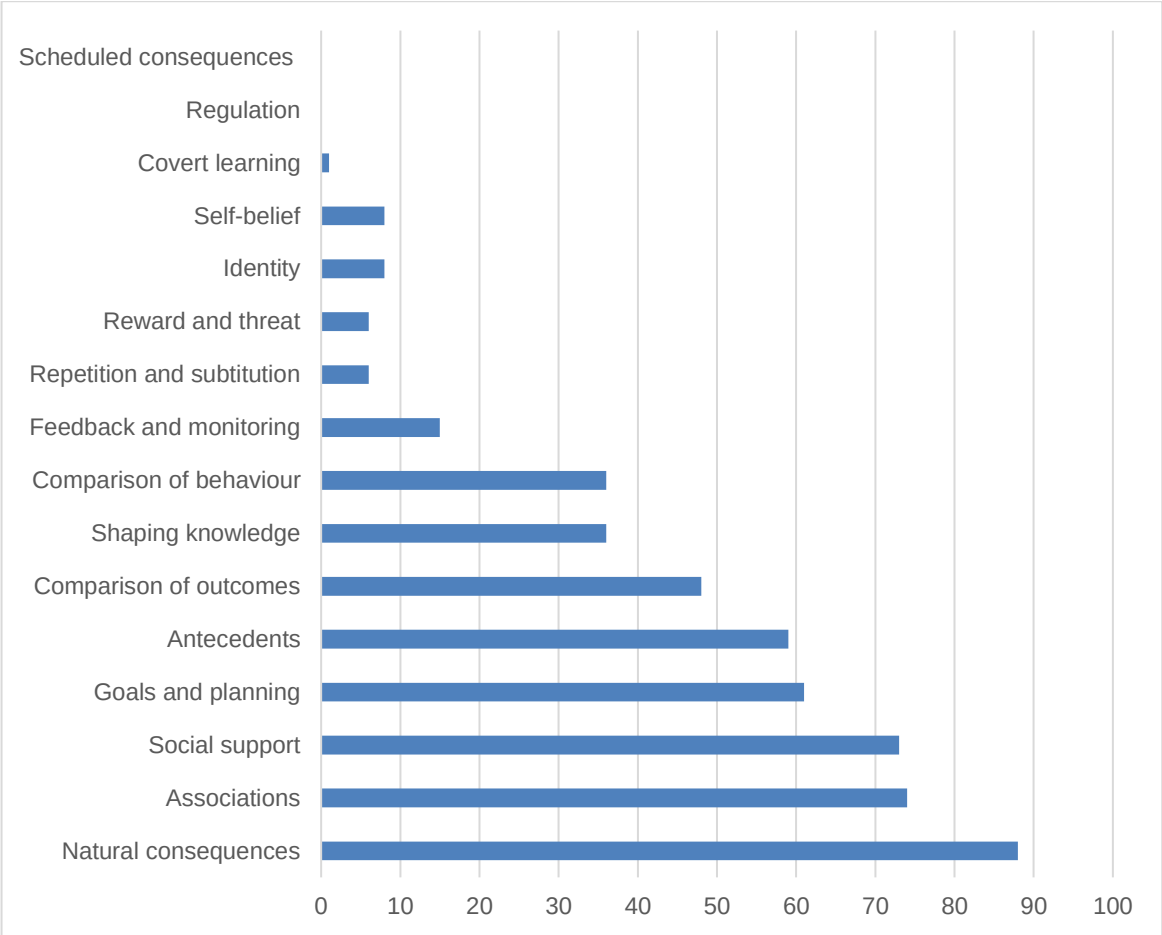

Figure 2. 5. Behaviour change techniques grouped into their 16 taxonomy clusters and ranked by frequency.

Results from the moderator analyses examining whether BCTs moderated overall study effect size are summarised below by level of participant SES (see Table 2.6 below). For the *non-low SES* studies, the BCT 'Social Support (unspecified)', defined as advising on or arranging and/or providing social support for performance of the behaviour, moderated intervention effect size, with studies that incorporated this BCT in their intervention resulting in a significantly greater effect size compared to those that did not (g = 0.391, p<.001 and g = .148, p<.001 respectively) and this difference in effect was statistically significant (Q_b (1) = 32.088, p < .001). 'Practical Social Support', defined as the provision of practical help for performance of the behaviour, also resulted into significantly greater effect sizes compared to studies that did not incorporated this BCT (g = 0.252, p<.001 and g = .149, p<.001 respectively) and this difference in effect was statistically significant (Q_b (1) = 11.61, p = .001). The BCT 'Instructions on how to Perform the Behaviour', defined as the provision of advice or agreeing with the participant how to perform the behaviour, was found to reduce study effect

size compared to studies that did not incorporate this BCT (g = .1514, p < .001 and g = .265, p < .001 respectively) and this difference in effect was statistically significant (Q_b (1) = 10.983, p = .001). The BCT 'Adding Objects to the Environment', defined within this context as any intervention that sent a free, stool-based screening kit in order to aid screening uptake, significantly increased study effect size compared to studies that did not incorporate this BCT (g = 0.227, p < .001 and g = .150, p<.001 respectively) and this difference in effect was statistically significant (Q_b (1) = 7.686, p < .001).

For the *low SES* studies, the BCT 'Problem Solving', defined as the process of analysing and/or prompting the person to analyse factors that influence their screening uptake and generate or select strategies that include overcoming barriers and/or increasing facilitators, appeared to reduce study effectiveness in increasing screening uptake compared to studies that did not incorporated this BCT into their intervention (g = .317, p<.001 and g = .505, p < .001 respectively) and this difference in effect size was marginally non-significant (Q_b (1) = 3.507, p = .061). Similarly, interventions that incorporated the BCT 'Practical Social Support' were also less effective compared to studies that did not incorporate this BCT (g = .304, p<.001 and g = .498, p < .001) and this difference in effect was marginally non-significant (Q_b (1) = 3.767, p = .052). Incorporating 'Instructions on how to Perform the Behaviour', resulted in a significantly greater effect size compared to studies that did not incorporate this BCT (g = .572, p<.001 and g = .315, p < .001 respectively) and this difference in effect was statistically significant (Q_b (1) = 6.183, p = .013). Additionally, 'Adding Objects to the Environment' was also a useful BCT in increasing study effect size compared to studies that did not incorporate this BCT (g = .632, p < .001 and g = .228, p < .001) and this difference in effect was statistically significant (Q_b (1) = 23.09, p < .001).

Table 2. 6. Summary of moderator analysis for behaviour change techniques (BCTs) for non-low SES vs. low SES[a] studies (k=105 vs. k=47 respectively)

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	SAMPLE									
	Non-low SES					Low SES				
Analysis	***k***	**Random effects model**		**Heterogeneity**	**Test for subgroup differences**	***k***	**Random effects model**		**Heterogeneity**	**Test for subgroup differences**
	105	**g, OR (95% CI)**	**P**	**Q, I^2 (%), P*h***	**(Q_{BET}, df, p)**	**47**	**g, OR (95% CI)**	**P**	**Q, I^2 (%), P*h***	**(Q_{BET}, df, p)**
BCT: Problem solving										
Yes	12	0.194, 1.421 (1.238-1.630)	p<0.001	140.8, p<0.001, 92.1%	0.271, 1, p=0.603	24	0.317, 1.778 (1.394-2.267)	P<0.001	169.8, p<0.001, 86.4%	3.507, 1, p=0.061
No	93	0.172, 1.367 (1.300-1.436)	p<0.001	2994, p<0.001, 96.9%	-	23	0.505, 2.504 (1.927-3.253)	P<0.001	319.7, p<0.001, 93.1%	-
BCT: Social support (unspecified)										
Yes	11	0.391, 2.035 (1.759-2.354)	p<0.001	234.6, p<0.001, 95.7%	32.088, 1, p<0.001	6	0.365, 1.940 (1.185-3.177)	P=0.008	26.66, p<0.001, 81.2%	0.091, 1, p=0.763
No	94	0.148, 1.308 (1.250-1.370)	p<0.001	2267, p<0.001, 95.8%	-	41	0.410, 2.105 (1.740-2.548)	P<0.001	479.0, p<0.001, 91.6%	-
BCT: Social support (practical)										
Yes	25	0.252, 1.580 (1.439-1.736)	p<0.001	489.7, p<0.001, 95%	11.61, 1, p<0.001	22	0.304, 1.736 (1.345-2.242)	P<0.001	115.8, p<0.001, 82.7%	3.767, 1, p=0.052

No	80	0.149, 1.310 (1.242-1.382)	P<0.001	2568, p<0.001, 96.9%	-	25	0.498, 2.473 (1.930-3.170)	P<0.001	371.0, p<0.001, 93.5%	-
BCT: Instructions on how to perform the behaviour										
Yes	18	0.265, 1.617 (1.452-1.801)	P<0.001	453.2, p<0.001, 96.2%	10.983, 1, p=0.001	17	0.572, 2.827 (2.097-3.810)	P<0.001	339.0, p<0.001, 95.2%	6.183, 1, p=0.013
No	87	0.154, 1.321 (1.255-1.392)	P<0.001	2674, p<0.001, 96.7%	-	30	0.315, 1.773 (1.430-2.197)	P<0.001	122.1, p<0.001, 76.2%	-
BCT: Information about health consequences										
Yes	54	0.176, 1.378 (1.290-1.471)	P<0.001	1004, p<0.001, 94.7%	0.000, 1, p=0.993	26	0.473, 2.361 (1.860-2.997)	P<0.001	393.3, p<0.001, 93.6%	2.399, 1, p=0.121
No	51	0.176, 1.377 (1.284-1.476)	P<0.00[1]	2085, p<0.001, 97.6%	-	21	0.316, 1.777 (1.358-2.326)	P<0.001	114.7, p<0.001, 82.5%	
BCT: Demonstration of the behaviour										
Yes	12	0.292, 1.701 (1.330-2.175)	P<0.001	295.0, p<0.001, 96.2%%	3.667, 1, p=0.055	10	0.466, 2.330 (1.577-3.444)	P<0.001	115.5, p<0.001, 92.2%	0.394, 1, p=0.530
No	93	0.158, 1.331 (1.269-1.397)	P<0.001	2816, p<0.001, 96.7%	-	37	0.388, 2.025 (1.651-2.482)	P<0.001	382.8, p<0.001, 90.5%	-
BCT: Adding objects to the environment										
Yes	27	0.227, 1.510 (1.386-1.647)	P<0.001	785.7, p<0.001, 96.6%	7.686, 1, p=0.006	18	0.632, 3.153 (2.502-3.974)	P<0.001	226.2, p<0.001, 92.4%	23.09, 1, p<0.001
No	78	0.150, 1.312 (1.248-1.379)	P<0.001	1769, p<0.001, 95.6%	-	29	0.228, 1.512 (1.249-1.830)	P<0.001	94.33, p<0.001, 70.3%	-

Notes. BCT = Behaviour Change Technique, *k* = number of comparisons, *g* = Hedge's g, OR = Odds Ratio, CI = Confidence Interval, Ph = p value of Q-test for heterogeneity, Q_b = Q value indicating the between-group effect.

2.3.4.3.1.2. Moderator analyses: Reported theory use

Moderator analyses for reported theory use included only the studies that reported using theory to develop the intervention either in the *Introduction* or the *Methods* section of the paper (*k* = 44, 28.9%). Due to the relatively small sample of studies reporting use of theory, it was decided to conduct the analysis without splitting by level of SES as done in earlier analyses (i.e., main moderator analyses seen in Table 2.4 and BCT moderator analyses seen in Table 2.6) in order to avoid having modest cell sizes that could compromise our ability to draw robust conclusions about the usefulness of theory-driven interventions. Nine items (as outlined in section 2.2.4. above) from Michie and Prestwich's TCS were included in the analysis and each of these items was evaluated as an independent moderator of overall effect size.

Out of *k* = 44 studies, *k* = 18 (40.9%) reported to be based on a single theory, none of the studies reported using theory to recruit study participants, *k* = 37 (84.0%) reported that they used theory to select and/or develop intervention techniques, and *k* = 23 (52.3%) reported using theory to tailor intervention techniques to participants. Of these *k* = 44 studies, *k* = 16 (36.3%) reported that all intervention techniques were explicitly linked to at least one of the theory-relevant construct/predictor, while *k* = 24 (54.5%) reported that at least one of the intervention techniques had explicit links to theory-relevant constructs/predictors and *k* = 16 (36.3%) reported that a group of intervention techniques were linked to a group of constructs or predictors. Results indicated that none of the items were significant moderators of overall effect size. Table 2.7 below illustrates how theory was used across the *k* = 44 studies. A summary of the theories and/or models of behaviour seen in *k* = 44 studies included in the meta-analytic review can be found in Table 2.8. below.

Table 2. 7. Summary of moderator analysis[a] for Theory Coding Scheme variables for all included studies (k = 44).

FULL SAMPLE					
Theory item	**Random-effects model**			**Heterogeneity**	**Between group effect**
	k	**g, OR (95% CI)**	***p***	**Q, P*h*, I^2 (%)**	**(Q_b, df, *p*)**
1. Intervention based on single theory					
Yes	18	0.101, 1.202 (1.041-1.387)	*p* = 0.012	69.03, *p*<0.001, 75.3%	0.470, 1, *p* = 0.493
No	26	0.136, 1.281 (1.143-1.436)	*p*<0.001	208.5, *p*<0.001, 88%	
2. Theory/predictor used to select recipients for the intervention					
Yes	0	-	-	-	-
No	44	0.119, 1.242 (1.143-1.349)	*p*<0.001	277.6, *p*<0.001, 84.5%	-
3. Theory/predictor used to select/develop intervention to techniques					
Yes	37	0.100, 1.200 (1.106-1.302)	*p*<0.001	137.9, *p*<0.001, 73.9%	1.683, 1, *p* = 0.194
No	7	0.169, 1.359 (1.147-1.610)	*p*<0.001	58.48, *p*<0.001, 89.7%	
4. Theory/predictors used to tailor intervention techniques to recipients					
Yes	23	0.094, 1.186 (1.048-1.342)	*p* = 0.007	45.02, *p*=0.003, 51.1%	1.156, 1, *p* = 0.282
No	21	0.146, 1.303 (1.157-1.466)	*p*<0.001	204.9, *p*<0.001, 90.2%	
5. All intervention techniques explicitly linked to at least one theory-relevant construct/predictor					
Yes	16	0.079, 1.155 (1.032-1.293)	*p* = 0.012	85.32, *p*<0.001, 82.4%	2.181, 1, *p* = 0.140
No	28	0.142, 1.295 (1.171-1.432)	*p*<=0.001	119.5, *p*<0.001, 77.4%	
6. At least one, but not all, of the intervention techniques are explicitly linked to at least one theory-relevant construct/predictor					
Yes	24	0.137, 1.283 (1.133-1.452)	*p*<0.001	40.14, *p*=0.015, 42.7%	0.474, 1, *p* = 0.491
No	20	0.105, 1.210 (1.084-1.350)	*p* = 0.001	225.5, *p*<0.001, 91.5%	
7. Group of techniques are linked to a group of constructs/predictors					
Yes	16	0.172, 1.367 (1.165-1.605)	*p*<0.001	28.08, *p*=0.021, 46.5%	1.918, 1, *p* = 0.166
No	28	0.100, 1.198 (1.090-1.318)	*p*<0.001	235.4, *p*<0.001, 88.5%	
8. All theory-relevant constructs/predictors are explicitly linked to at least one intervention					
Yes	11	0.070, 1.134 (0.994-1.295)	*p* = 0.062	53.22, *p*<0.001, 81.2%	2.256, 1, *p* = 0.133
No	33	0.138, 1.285 (1.170-1.411)	*p*<0.001	160.8, *p*<0.001, 80%	
9. At least one, but not all, of the theory-relevant constructs/predictors are explicitly linked to at least one intervention technique					
Yes	26	0.132, 1.270 (1.128-1.430)	*p*<0.001	72.94, *p*<0.001, 65.7%	0.271, 1, *p* = 0.603
No	18	0.107, 1.215 (1.082-1.365)	*p* = 0.001	197.9, *p*<0.001, 91.4%	

Notes. [a]Moderator analysis included only the studies that reported using theory to develop the intervention either in the introduction or methods sections. *k* = number of comparisons, *g* = Hedge's *g* measure of effect size, OR = Odds Ratio, CI = Confidence Interval, Ph = p value of Q-test for heterogeneity, Q_b = q value indicating the between-group effect.

Table 2. 8. Summary of theories/models of behaviour used in 28 of the studies (k = 44) included in the meta-analytic review.

Theory	Key constructs	Studies of meta-analysis addressing theory
Health Belief Model (Rosenstock, 1974)	✓ Perceived susceptibility ✓ Perceived severity ✓ Perceived benefits ✓ Perceived barriers ✓ Cues to action	Fitzgibbon et al (2007); Gimeno-Garcia et al (2009); Hendren et al (2013); Holt et al (2012); Jensen et al (2014); Marcus et al (2005); Maxwell et al (2010); Menon et al (2011); Price-Haywood et al (2014); Salimzadeh et al (2014); Wardle et al (2003); Basch et al (2006); Davis et al (2013); Myers et al (2007); Krok-Schoen et al (2015);
Stages of change/Transtheoretical model (DiClemente & Prochaska, 1998)	✓ Pre contemplation stage ✓ Contemplation stage ✓ Preparation stage ✓ Action stage ✓ Maintenance stage	Marcus et al (2005); Menon et al (2011); Lasser et al (2011); Vernon et al (2011); Pignone et al (2000); Walsh et al (2010)
Social Cognitive Theory (Bandura, 1998)	✓ Behavioural capability ✓ Reciprocal determinism ✓ Outcome expectations ✓ Self-efficacy ✓ Observational learning ✓ Reinforcement	Braun et al (2005); Hewitson et al (2011); Krok-Schoen et al (2015); a et al (2004)
Theory of planned behaviour (TPB) (Ajzen, 1991, 2002b; Ajzen & Madden, 1986)	✓ Intention ✓ Attitudes towards a behaviour ✓ Subjective norms ✓ Perceived behavioural control (PBC)	Wardle et al (2003)
Implementation Intentions (Gollwitzer, 1993)	✓ Motivational phase: phase of formation intention ✓ Volitional phase: planning of goal pursuit through forming 'if-then' plans	Lo et al (2013); Neter et al (2014)

Protection Motivation Theory (Rogers, 1983)	✓ Threat appraisal (perceived severity + perceived susceptibility) ✓ Coping appraisal (self-efficacy + response efficacy)	Cameron et al (2011); Katz et al (2012)
Approach/Avoidance Motivation, Message framing (Kahneman & Tversky, 1981; Rothman & Salovey, 1997)	✓ Gain frame: Benefits of engaging in behaviour made salient ✓ Loss frame: costs of failing to engage in behaviour made salient	Hewitson et al (2011); Lipkus et al (2003); Schroy et al (2012); Sequist et al (2009); Sequist et al (2011)
Precaution Adoption Process Model (PAPM) (Weinstein, 1988; Weinstein, Rothman, & Sutton, 1998)	✓ Stage 1: Unaware of Issue ✓ Stage 2: Unengaged by issue ✓ Stage 3: Undecided about acting ✓ Stage 4: Decided not to act ✓ Stage 5: Decided to act ✓ Stage 6: Acting ✓ Stage 7: Maintenance	Costanza et al (2007); Ritvo et al (2015); Wilson et al (2015)
Actor-Partner Interdependence Model (APIM) (Cook & Kenny, 2005)	The effect of a person's (e.g. partner's X variable) on the person's Y variable - assesses how members of a dyad (i.e., couple) influence each other's behaviours simultaneously	Manne et al (2013)
Preventive Health Model	Integrates theoretical components from Theory of Reasoned Action, Social Learning Theory and Health Belief Model	Myers et al (2007); Salimzadeh et al (2014)
General Model of Determination of Behaviour Change (a synthesis of behavioural theories)	Main determinants of behaviour: ✓ Attitudes ✓ Perceived norms ✓ Self-efficacy ✓ Ability to perform the behaviour	Potter et al (2011)
Self-Determination Theory (Ryan & Deci, 2000)	Identifies three psychological needs that predict behaviour: ✓ Autonomy (feeling of being the origin of one's	Resnicow et al (2014)

	own behaviours) ✓ Competence (feeling effective) ✓ Relatedness (feeling understood and cared for by others)	
Anticipated Regret	By anticipating regret – a strong negative affect – people may take action to avoid actually experiencing this emotion	Wardle et al (2003); O'Carroll et al (2015)
Cognitive-Social Information Processing Model (Miller, Brody, & Summerton, 1988)	Supports that people can have 2 distinct attentional styles and each style is associated with different behavioural reactions ✓ High monitoring (information seeking) ✓ Low monitoring (information distracting)	Weinberg et al (2013)
Question-Behaviour Effect	Supports that questioning people about a future behaviour influences the subsequent performance of that behaviour	O'Carroll et al (2015)
Attitude Accessibility Theory (Fazio, Powell, & Williams, 1989)	Attitude accessibility refers to the ease with which attitudes can be retrieved from memory and plays a key role in the attitude-behaviour link ✓ If attitude is memorable → Immediate impact on behaviour ✓ If attitude is not memorable → Will only have an impact on behaviour when recalled	Krok-Schoen et al (2015)
Elaboration Likelihood Model (Petty & Cacioppo, 1986)	Proposes there are two routes to attitude change; (1) the central route which leads to enduring attitude change that is predictive of behaviour; (2) the peripheral route where attitudes may remain unchanged and is dependent on the individual's motivation	Ruffin et al (2007)

2.3.4.4. Publication Bias

Funnel plot investigation (see Figure 2.6) revealed that studies were not distributed symmetrically about the mean effect size, therefore indicating the presence of publication bias. Specifically, the plot indicated a suppression of studies on the left side of the mean, suggesting that there might be studies missing from the left rather than the right. The adjusted funnel plot (see Figure 2.7.) indeed indicated that there were eleven imputed studies (indicated in the plot as red circles). To further investigate the impact of the observed publication bias on the overall effect size, the Duval and Tweedie (2000) iterative trim and fill test was conducted. This test was used to demonstrate how the summary effect size would shift, if apparent bias was to be removed (i.e., removal of most extreme small studies from the sample of studies). The Duval and Tweedie test showed that the unadjusted odds ratio corresponded to a value of 1.493 (95% CI: 1.428-1.560) whereas the adjusted odds ratio was 1.458 (95% CI: 1.395-1.524), suggesting an adjusted estimate that was fairly close to the original. Therefore, the impact of publication bias was concluded to be present but unlikely to have substantive implications on interpreting the overall effect.

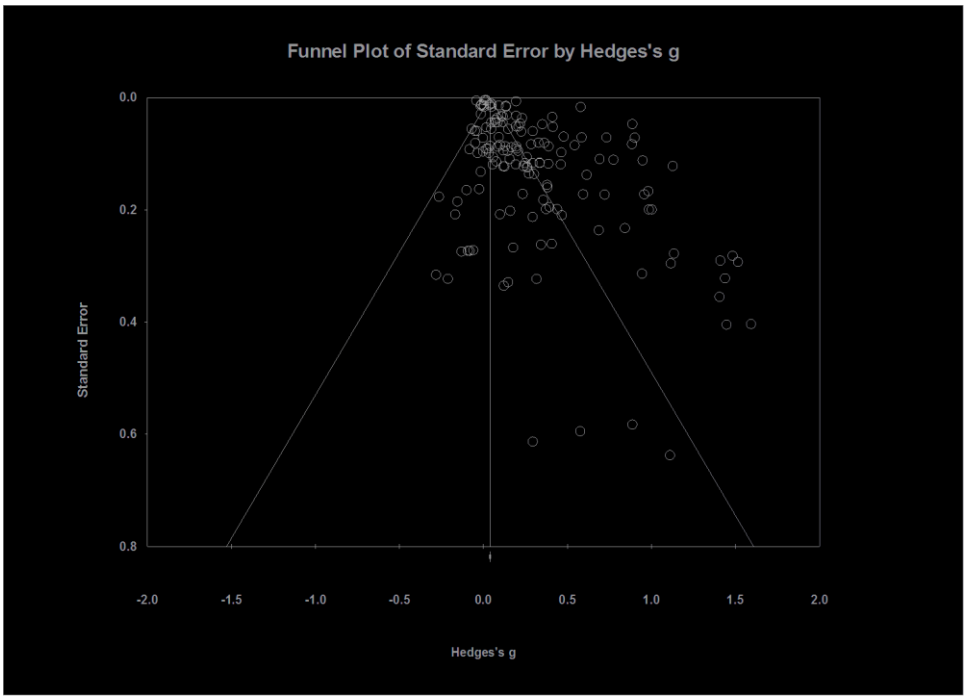

Figure 2. 6. Unadjusted funnel plot of the studies included in the meta-analysis.

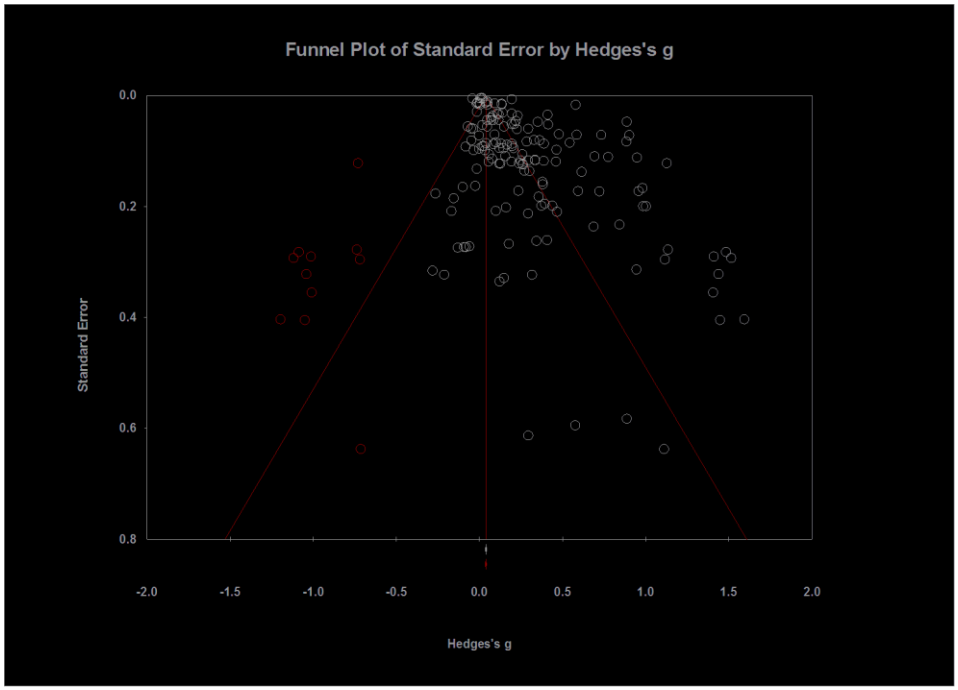

Figure 2. 7. Adjusted funnel plot of the studies included in the meta-analysis with the nine additional studies estimated by the trim and fill analysis.

2.3.5. Additional Analyses

As indicated earlier in this chapter, variables were considered to be confounded with one another if the shared variance exceeded 25% (i.e., r >.5). Results of the correlation analyses revealed the variables contact type (with two levels: in person/mixed or remote) and intervention delivery (with two levels: one-to-one or group/mixed delivery) were confounded. Specifically, results indicated that interventions that were delivered in person or those that incorporated both aspects that were delivered in person and remotely, were less likely to be delivered on a one-to-one basis, therefore indicating that these types of interventions were more likely to be delivered in groups (r = -0.501, k = 152, p < .001). The confounding of these two moderators has implications on the interpretation of effect sizes. The strong association between contact type (i.e., face-to-face, remote, or mixed contact type) and delivery format (i.e., individual or group/mixed delivery format) makes it difficult to disentangle the relationship between the type of intervention and CRC screening uptake rates. It therefore remains unclear which moderator is more important for increasing intervention effectiveness - is it contact

type or is it delivery format that drives the observed effect sizes? For results of all correlation analyses see Appendix 2.13.

2.4. Discussion

The overall aim of this meta-analysis was to quantitatively review the evidence of the effectiveness of health interventions to improve CRC screening rates. This review also sought to examine the evidence of the effectiveness of health interventions on CRC screening rates among populations of higher socioeconomic disadvantage. Finally, this review aimed to assess the relative effects of contributing factors (i.e., moderators) on CRC screening uptake.

2.4.1. Summary of Principal Findings

We identified 102 studies incorporating 152 interventions and a sample population of 1.92 million participants. Studies used a wide range of methods to increase CRC screening uptake rates. Most interventions were conducted in the US, were delivered remotely, relied on the use of paper-based materials and were conducted through primary care settings. Approximately one third of interventions reported using theory to develop the content of intervention materials. Studies predominantly used objective strategies to assess screening uptake and most studies were classified as having high or unclear risk of bias. The most frequently identified BCT used in interventions was 'Information about Health Consequences'.

The principal finding of this review is that, across all studies, the receipt of a health intervention led to a significant increase in CRC screening rates. The meta-analysis estimated a small, but significant, post-intervention summary effect size (g = 0.26, p<.001). This review also provides reasonably strong evidence that health interventions significantly improved CRC screening rates among socioeconomically vulnerable populations with traditionally low screening participation rates such as ethnic minorities, low-income and medically underserved populations. Specifically, the pooled effect of the 47 studies delivered to low SES study samples, showed an overall effect of 2.1 times higher likelihood for participants in the intervention group to be screened for CRC, compared to participants in the comparison/control group. When comparing the estimated summary effect sizes between the disadvantaged and more privileged populations, results showed a significantly greater effect size for interventions delivered to the low SES sample of participants (g = 0.40, p

< .001), compared to the effects size calculated for the non-low SES studies (g = 0.17, p < .001). Although the delivery of health interventions significantly increased CRC screening for both disadvantaged and more affluent populations, results indicate that underprivileged patients may benefit from health interventions substantially more than less disadvantaged populations. The small effect size among the *non-low SES* studies may be, to an extent, the result of a ceiling effect caused by potentially greater CRC screening rates among participants of a higher socioeconomic status, which could potentially leave a smaller proportion of participants in whom effects of the intervention could be observed. However, even a small effect size is noteworthy when contemplating the possibility to improve the prognosis of the approximately 1,361,000 people who are diagnosed with CRC each year (GLOBOCAN 2012; Ferlay et al., 2015).

In the control condition, screening uptake was 19% higher for the non-low SES populations compared to low SES populations, whereas this difference in uptake was reduced to 7.5% in the experimental condition, indicating that the gap between the highest and lowest levels of socioeconomic deprivation was substantially reduced (by 11.5 percentage points) and that the delivery of health interventions led to a significant improvement in equitable delivery of CRC screening. This is a particularly promising finding since it indicates that the public health interventions reviewed here led to a reduction in screening inequalities. It is also encouraging that interventions did not widen screening inequalities by disproportionately benefitting less disadvantaged populations, which is not a rare occurrence in the area of research focusing on health inequalities (Lorenc, Petticrew, Welch, & Tugwell, 2013; McGill et al., 2015). Indeed, the findings presented here suggest that if vulnerable populations benefit from health interventions as strongly as indicated by these results, it can be expected that if similar strategies were to be implemented in public health policy, an overall gradual reduction of the socioeconomic gradient in CRC screening would follow. The need for implementing interventions that reduce CRC screening disparities has been widely recognised as a central precursor for reducing disparities in cancer mortality (Von Wagner, Baio, et al., 2011).

2.4.2. Interpretation

In order to further understand the mechanisms behind the positive impact of health interventions on CRC screening uptake rates, among both less and more socioeconomically disadvantaged populations, a range of moderator variables were examined. Moderation effects revealed significant variation in screening behaviour between the *low* and *non-low SES* studies.

2.4.3. Intervention Characteristics as Moderators

2.4.3.1. Intervention delivery mode

Our findings suggest that for low-income subgroups it was more effective to implement interventions remotely rather than face-to-face, or administer interventions that involved both types of contact. Contrary to this finding, for the *non-low SES* populations the strongest effect size emerged for interventions that relied on having face-to-face contact with the interventionist or mixed contact. For face-to-face interventions, it is common for interventionists to present statistics and numerical risk estimates, use specialist medical terms and might also prompt participants to engage in a conversation about their health. Dialogue-based health communication, as well as the complexities of the health information to be communicated, might represent significant challenges for patients with poor literacy, lower educational attainment or individuals for whom English is not their first language, thereby potentially decreasing participants' understanding of and attention towards the health promotion messages being delivered. However, it was not feasible for this review to investigate the content or the communication style used in interventions, and therefore it was not possible to assess whether such factors mediated the difference in effect size observed among the two SES groups.

The finding that effect sizes for individual-based interventions (i.e., one-to-one) were significantly greater compared to group-based interventions aligns with our prediction, that health communication about CRC screening, delivered in a group setting, might compromise participants' acceptability of health promotion messages. This finding was consistent across both SES groups. It is unclear whether group-based interventions are less effective due to the sensitive nature of the discussions surrounding CRC and CRC screening - which could, in turn, make participants more hesitant to disclose personal health information - or whether it is

that group dynamics influence how health messages are received, and this was outside the scope of the present meta-analysis. The literature does however show, that cancer and cancer screening constitute taboo matters, especially among minority groups (Karbani et al., 2011; Palmer, Thomas, McGregor, von Wagner, & Raine, 2015; Raymond et al., 2014; Robb, Solarin, et al., 2008; Thomas, Saleem, & Abraham, 2005), and therefore it seems reasonable to suggest that an individualised mode of delivery is superior to group-based interventions within the context of CRC screening. Nevertheless, only a small number of studies (k = 14) were classified as being group-based or mixed – that is, they contained both group- and individual-based components - and therefore it was not possible to extract conclusive evidence regarding the effectiveness of group-based interventions to increase CRC screening. Indeed, there seems to be a significant lack of literature comparing the effectiveness of group- and individual-based interventions within the wider context of cancer screening. From the patient's perspective, the intervention mode of delivery might have implications for acceptability and can affect overall intervention effectiveness (Sekhon et al., 2017). A suggestion for further study would be to explore whether the relationship between group- and individual-based interventions and intervention effectiveness is mediated by the acceptability of health promotion messages to a recipient.

In terms of intervention materials, delivering CRC screening promotion messages by using a combination of electronic media and paper-based media, translated into increased CRC screening rates for socioeconomically disadvantaged populations, yielding a large effect size (g = 0.78. p<.001). However, the evidence available in support of this delivery mode, is very limited as only three studies (Aragones, Schwartz, Shah, & Gany, 2010; Katz, Fisher, Fleming, & Paskett, 2011; Tu et al., 2006) were classified as using this combination of intervention materials. It is worth noting however, that all three of the aforementioned studies incorporated a video element, suggesting that there may be added value in engaging patients through the use of videos in web-based health interventions. This is in agreement with previous research that has shown that information presented in video-format is associated with improved recall of health-related information and improved engagement, when compared to other emerging technologies, such as text messages (Koehler, Yadav, Phillips, & Cavazos-Kottke,

2005; Yadav et al., 2011). The findings also suggest that paper-based materials – including invitation letters and information pamphlets on CRC cancer screening – combined with additional telephone reminders, and/or health communication over the phone, demonstrated a positive effect on CRC screening rates. For the majority of included studies, a phone call either acted as a reminder for screening uptake, or as a means to further communicate the importance of CRC screening to participants. The critical role of adding a phone call was demonstrated in six trials, which compared postal invitation with postal invitation *plus* telephone outreach and reported an advantage for adding a telephone call in the intervention (Church et al., 2004; Fortuna et al., 2014; Green et al., 2013; Levy, Xu, Daly, & Ely, 2013; Myers et al., 2007; Walsh et al., 2010). These findings highlight that a letter of invitation, or a leaflet about the benefits of screening alone, might not be enough to motivate participants to take part in screening. In line with the conclusions of previous systematic reviews (Baron et al., 2008; Everett et al., 2011; Jepson et al., 2000) the evidence presented here suggests that telephone contact is associated with increased screening compliance and this finding has been observed across CRC, breast and cervical cancer screening programmes. More recently, a few papers have highlighted that a phone call component might be particularly beneficial for people who have never or have infrequently undergone screening (Ferroni et al., 2012; Musa et al., 2017). Therefore, the findings presented here suggest that in a population of eligible individuals, who are often considered *hard-to-reach* based on greater socioeconomic deprivation, following-up screening invitations with phone reminders, and/or offering further information about the benefits of CRC screening through the phone, could potentially lead to substantial increases in CRC screening rates. Over-the-phone health communication also offers the chance for personal contact with someone knowledgeable about CRC screening, which might be an effective method of health communication, especially for individuals who might feel anxious about the screening process, but simultaneously feel apprehensive to discuss directly with their doctor.

2.4.3.2. Intervention provider

In terms of the intervention provider, the pattern of evidence observed between low-income and more affluent subgroups was substantially different; for the *low SES* studies, the results suggested that clinically trained health

professionals (including doctors and nurses) and research staff can deliver more effective interventions for increasing CRC screening rates, whereas for the more privileged populations, having non-clinically trained health professionals deliver health interventions was shown to be most effective. The finding that medical staff and researchers result in greater intervention effectiveness for socioeconomically disadvantaged populations contests previous evidence, which has extensively shown that the involvement of lay health educators and advisors in health promotion programmes and interventions has been successful in improving health behaviours and outcomes among many socially disadvantaged groups (Bonevski et al., 2014; Henderson, Kendall, & See, 2011; Montgomery & Jones Schubart, 2010; Norris et al., 2006; Spencer et al., 2011; Swider, 2002). The results presented here suggest that healthcare providers might have a fundamental role in recommending screening, and factors such as the delivery provider's professional training, level of experience with delivering health interventions, the interpersonal style involved in the communication and the quality of the participant-provider interactions might all have the potential to affect outcomes either directly, or indirectly by having an impact on intermediate predictors of outcomes. For instance, there might be important differences between medical professionals and lay educators with regards to their interpersonal style involved in the communication between themselves and patients/participants, which might in turn affect personal relatedness (Beall et al., 2014; Silva, Marques, & Teixeira, 2014). Whether relatedness is a factor that could affect the successful delivery of interventions to increase CRC screening rates is a potential area for future research.

2.4.3.3. Intervention setting

Wirth regards to whether the setting in which the intervention was delivered impacted on intervention effectiveness, results indicated that interventions delivered in the community setting resulted in greater effect sizes for both disadvantaged and non-disadvantaged populations. More specifically, community-based interventions were significantly more effective for underprivileged populations than they were for more affluent populations. This is in agreement with previous evidence, which highlights that community-based interventions might

motivate greater behaviour change among socioeconomically deprived and marginalised populations, partly because they have the potential to connect study participants to aspects of their social environment (Bonevski et al., 2014; Kreuter, McQueen, Boyum, & Fu, 2016). Indeed, there is a growing movement of research aiming to reduce health inequalities by engaging members of the community in public health interventions - for instance, through the use of participatory research methods. The current evidence base suggests that the involvement of under-represented communities can help contextualise an intervention within that specific setting, thereby increasing the likelihood of delivering interventions that can help eliminate disparities and bridge the gap between scientific research and public health policy (Belone et al., 2016; Israel et al., 2010; Trickett & Beehler, 2013; Wallerstein & Duran, 2010). In the present review, approximately 50% of interventions that were delivered to socioeconomically disadvantaged populations, were classed as being community-based, whereas less than a fifth of the studies targeting less socioeconomically disadvantaged populations were delivered in a community setting; an observation which lends its support to the trend observed in the literature, that posits a growing interest of researchers and academics in involving underserved communities in public health research, and especially in research that is concerned with the reduction of health inequalities. In terms of how community engagement in public health interventions was operationalised in the present review, community-based interventions took many forms. The majority of studies engaged underserved communities by providing information about the benefits of screening and offered further consultation with regards to the screening process – which is considered minimal engagement based on the five-rung ladder of participation proposed by (Wilcox, 1994) – and only a few community-based studies incorporated greater levels of involvement, such as joint decision-making and acting together (e.g., Christie et al., 2008; Horne et al., 2015; Lasser et al., 2011; Maxwell et al., 2016; Percac-Lima et al., 2009). The latter levels of engagement are thought to lead to greater behaviour change that is more likely to be sustained long-term. It is important to note, that researchers face important challenges when conducting community-based participatory research – for instance the identification, recruitment and engagement of community representatives is a considerable barrier – however, from the findings presented

here, a heavier reliance upon community-based interventions may be advisable and appear to have greater potential to increase CRC screening uptake for populations with greater socioeconomic disadvantage and thereby reduce health inequalities.

2.4.3.4. Intervention screening modality

The variation of study effectiveness by type of screening modality revealed significant differences between populations with higher and lower SES. A large and statistically significant effect size was observed for interventions using stool-based screening procedures among more disadvantaged populations, whereas for more privileged populations, endoscopic screening procedures appeared to be more effective. One explanation could be, that the greater level of invasiveness of endoscopic screening procedures represents an additional barrier, among the multiple others, that populations with greater socioeconomic disadvantage usually face. It may be also be that individuals with higher SES might be more knowledgeable and appreciate the advantages of undergoing an endoscopic screening procedure – for instance, the fact that they are diagnostic in nature, the greater time interval required between repeat examinations compared to stool-based screening procedures, as well as the opportunity to instantaneously remove polyps during the examination - all of which are considerable advantages of endoscopic procedures. The finding that intervention effectiveness varies as a result of screening modality – and therefore each method's level of invasiveness - is not directly relevant to the UK health system - which provides universal, comprehensive healthcare free at the point of delivery and has implemented the provision of free CRC screening via FIT/gFOBT through the NHSBCSP - it might, however, offer some insights to the, heavily private, US health system, whereby the type of screening modality available is reliant on patients' health insurance.

2.4.3.5. Use of theory

Findings with regards to the extensiveness of reported theory use on intervention effectiveness were mixed. For both disadvantaged and more affluent study samples, higher levels of reported theory use to guide intervention development was not a moderator of health intervention effectiveness. However,

sparse/moderate reported use of theory was associated with a significantly larger effect size, but this effect was only observed among non-low SES participants. This finding runs counter to some previous research, which has indicated that greater use of theory to guide intervention development, maximises intervention effectiveness (Bluethmann, Bartholomew, Murphy, & Vernon, 2017; Johnson, Carey, Chaudoir, & Reid, 2006). However, the findings regarding the association between theory use and intervention effectiveness are largely inconsistent and the evidence remains inconclusive. The effects of theory use on intervention effectiveness presented here should be interpreted with caution; subgroup sample sizes for assessing theory use as a moderator were mostly small, thereby limiting the power to robustly assess differential effectiveness. While most studies clearly justified why theory use was considered essential in achieving greater CRC screening uptake, the actual application of theory use in the planning and evaluation stage was largely inadequate. Overall, only one third of all included studies reported using theory to inform intervention development, and the majority of studies were classed as having sparse or moderate extensiveness of theory use and where characterised by a lack of explicit detail with regards to specifying exactly how theory was integrated into the design, implementation and evaluation of interventions. The ambiguous reporting of theory use application made it difficult to distinguish its impact on screening behaviour post-intervention, and highlights the ongoing need to effectively assess how theory is applied in intervention development. It might be of particular importance for future research to develop a framework, that will allow the differentiation between ‘theory-informed’ and ‘theory-based’ interventions, and to critically assess whether such a distinction impacts on intervention effectiveness. Additionally, of particular importance for examining the relationship between theory application and intervention effectiveness, is the notion of implementation fidelity, which refers to the need for congruency between intended design and intervention delivery (Dusenbury, Brannigan, Falco, & Hansen, 2003). Implementation fidelity, and indeed the lack of, has been recognised as a major methodological limitation in health intervention research and is also thought to be a factor that can interfere with how optimally theory is operationalised in practice (Prestwich et al., 2014). Unless more studies of higher fidelity are conducted, it remains largely unclear what the impact of theory is on

intervention effectiveness. Within the context of the current review, the possibility of effect sizes being confounded by study fidelity with regard to theory use was considered to be high, and therefore this review cannot provide clear recommendations on what extent of theory use or which specific theoretical models would be well-suited for public health interventions aiming to increase CRC screening uptake.

2.4.4. Participant Characteristics as Moderators

The present review found that older age was associated with a significant reduction in intervention effectiveness, however, this result was only observed among more affluent participants. Perhaps older participants did not perceive that they needed to adhere to screening recommendations, despite the fact that older age is among the most prominent risk factors of CRC. Previous studies have shown that greater knowledge of risk factors of cancer and cancer prevention, is associated with significantly greater cancer screening uptake (Abotchie & Shokar, 2009; Atkinson, Salz, Touza, Li, & Hay, 2015; Koo et al., 2010; Liao, Wang, Lin, Hsieh, & Sung, 2006; Lyimo & Beran, 2012). Although awareness about CRC may be an important determinant, it is likely that it is the combination with other factors that will ultimately determine whether people adhere to screening guidelines. Further research in similar populations is needed to better understand how age might interact with other factors (e.g., knowledge) to influence effectiveness of health interventions aiming to increase CRC screening uptake.

The current findings suggest that gender does not have an impact on intervention effectiveness, indicating that men and women benefit equally from health interventions with regards to CRC screening uptake. Previous findings have suggested that men are less likely to adhere to CRC screening recommendations, and hence are at a higher risk for diagnosing CRC during later stages when treatment is less likely to be successful, therefore it is promising that interventions were equally beneficial for both genders.

Similarly, prior family history of CRC did not moderate intervention effectiveness, and this finding was consistent across populations of both higher and lower socioeconomic disadvantage. Being up-to-date with screening at the

start of the study was associated with slightly worse screening outcomes among less disadvantaged participants. This might indicate the presence of a ‘ceiling-effect’; participants from more affluent backgrounds that were up-to-date with CRC screening at baseline might not allow further improvements in uptake to be observed, and for participants already adhering to screening recommendations, providing additional materials related to cancer screening, might cause frustration and could negatively affect participants’ acceptability of health-related information, which could potentially explain the reduction in intervention effectiveness observed here.

2.4.5. Methodological Characteristics as Moderators

Two methodological characteristics were examined as moderators in the present meta-analysis. Firstly, the method of assessing screening uptake was examined in subgroup analysis, with results showing a significant, small-to-medium effect for studies that used objective measures of CRC screening rates, among socioeconomically vulnerable populations. It is worth noting, that among this population, a significantly larger effect was evident for objective measures compared to self-report measures. These findings suggest that the positive effects of health interventions observed among low-income and racially diverse study samples, cannot be attributed to self-report indices (e.g., social desirability, detection bias, ‘better-than-average’ effect), rather the results are clearly observable with measures of screening uptake beyond self-report biases. This finding contests previous research that has demonstrated that trials relying on self-report tend to inflate intervention effects and threaten the validity of the findings (Colditz, Miller, & Mosteller, 1989; Klonoff, 2009; Schulz, Chalmers, Hayes, & Altman, 1995; Truong, Paradies, & Priest, 2014). Secondly, it was also assessed whether the main result was influenced by study quality, using the comprehensive Cochrane risk of bias tool. Among interventions delivered to low-income subgroups, results indicated that study quality significantly moderated the effects of health interventions, and surprisingly, higher-quality studies were found to have a significantly greater effect compared to both studies with unclear and poorer quality. This result contradicts previous evidence that studies rated as having high risk of bias, on average, tend to overestimate intervention effect sizes compared

with studies at low risk of bias (Hartling et al., 2009; Higgins et al., 2011; Viswanathan et al., 2012). Similar to above, this finding implies confidence that results represent the true intervention effects and that the finding, that health interventions are significantly beneficial for the purposes of increasing CRC screening uptake, among socioeconomically disadvantaged populations, is considered valid. For the *non-low SES* studies, results indicated a significantly greater effect size for studies of unclear risk of bias when compared to both high and low risk of bias studies. The majority of studies that were considered as having unclear risk of bias were classified as such mainly due to missing or poorly reported information that did not allow secure risk of bias judgments to be made.

2.4.6. Behaviour Change Techniques (BCTs) as Moderators

The use of reminders – defined here broadly and included the use of messages reminders (both print and electronic), fridge magnets and brief feedback communicated to participants multiple times during the interventions, among others – was also examined as a potential moderator of intervention effectiveness. Results indicated that reminders generally led to positive effects for improving CRC screening rates compared to studies that did not incorporate reminders. This finding was consistent for both more and less disadvantaged populations, however, it was only for the more affluent participants that this difference in effect was statistically significant. Findings from a recent study (Kreuter et al., 2016) found that common intervention approaches, such as reminders, that promoted preventive health services, were differentially effective among participants with different patterns of unmet basic needs (e.g., food, housing, personal and neighborhood safety, money for necessities). Specifically, Kreuter et al (2016) reported that economically vulnerable populations did not benefit from reminders as much as they did from more intensive, patient-centric approaches, such as patient navigation. The relative ineffectiveness of reminders among populations of higher socioeconomic disadvantage observed here, can perhaps be explained by the fact that people that have dealt with prolonged financial insecurity, are more likely to avoid paying attention or even forget that such materials were received (Osterberg & Blaschke, 2005), in the presence of other pressing concerns and more urgent financial, medical and social needs. These findings suggest that the

effectiveness of conventional and minimal-contact intervention approaches, such as reminders, may to an extent be undermined among low-income subgroups due to unmet basic needs and heightened socioeconomic insecurity. Emerging findings from the area of health disparities research, is suggesting that 'upstream' prevention interventions – for instance, interventions that involve reforming healthcare policies that have greater potential of improving population-level health- with a focus on helping people meet their basic needs, are more likely to be associated with favourable public health implications and lead to more sustained behaviour change, compared to 'downstream' interventions, which rely solely on individuals making and sustaining behaviour change (Cappelletti, Kreuter, Boyum, & Thompson, 2015; McGill et al., 2015).

In order to account for heterogeneity, this review also aimed to further unpick the various BCTs that were used in the included studies, to identify which techniques might be associated with more favourable CRC screening-related outcomes, for which specific populations. Whilst there is a growing amount of review papers and meta-analyses examining whether BCTs increase intervention effectiveness (Cradock et al., 2017; Hartmann-Boyce, Johns, Jebb, & Aveyard, 2014; Olander et al., 2013; Samdal et al., 2017; Webb et al., 2010), at present, there is a lack of understanding of specific BCTs used in health interventions that aim to increase CRC screening rates, and there is little available evidence identifying BCTs that might lead to improved health outcomes for underserved and socioeconomically deprived populations. Across all the 102 trials, 39 out of the 93 BCTs in the BCTTv1 taxonomy were identified. Among less deprived populations, three BCTs were associated with significantly larger effect sizes: 'Social Support (unspecified)', 'Social Support (practical)' and 'Adding Objects to the Environment'. One BCT, 'Instructions on how to Perform the Behaviour', was associated with significantly smaller effect sizes. The pattern of findings differed substantially among interventions delivered to populations of greater socioeconomic disadvantage, where two BCTs were associated with significantly greater intervention effectiveness: 'Instructions on how to Perform the Behaviour' and 'Adding Objects to the Environment', and two BCTs were associated led to a significant reduction in intervention effectiveness: 'Problem Solving' and 'Social

Support (practical)'. It is rather surprising that social support had a differential impact on intervention effectiveness between less and more disadvantaged populations, and it is concerning that social support reduced intervention effectiveness among more socioeconomically deprived participants. One explanation could be that the type of social support provided was not tailored or culturally-relevant to the needs of the specific population. Indeed, there are certain factors that have shown to negatively affect the social-support-health relationship; for instance, satisfaction of social support depends on the conceptualisation of social support by the recipient and this is considered a main determinant of the relationship (Ford, Tilley, & McDonald, 1998; Morrison, 2015). Furthermore, a recent review has noted that preferences for the type of social support are substantially different depending on participants' race/ethnicity, geographical location and gender (Strom & Egede, 2012). Strom and Egede (2012) also highlight that the *source* of social support appears to be crucial with regards to how well support is received and that ethnic minority groups tend to rely more on support from family and friends, as compared with white populations, who tend to rely more on support from healthcare professionals and the media. This could explain the differential impact social support had on study effect sizes between *low* and *non-low SES* studies, since none of the studies involved the provision of support from participants' family and friend networks. Future research should consider providing social support in a way that is culturally-tailored and sensitive to the needs of the populations being served, which in turn might lead to greater engagement with interventions and facilitate the adoption of health promoting behaviours among disadvantaged populations. Findings from this review suggest that there is no association between the number of BCTs and intervention effectiveness.

2.4.7. Limitations

Despite using a thorough search strategy, there may be some literature on health interventions aiming to increase CRC screening uptake that was, unintentionally, not identified in this review. Additionally, this review was not exhaustive in that it did not include studies identified through reference lists of included studies, neither did it include 'grey literature' (i.e., unpublished documents and reports) on this topic. Some interventions with negative findings may not have

been published, therefore exaggerating the effect sizes reported in the literature; however, the test of publication bias, indicated that there were no statistical risks of publication bias.

Furthermore, there were additional variables that had been scheduled *a priori* to be included as moderators in subgroup analyses, such as variables related to past screening history – for example, number of past invites, percentage of people ever been screened using gFOBT, percentage of people ever been screened through other screening procedures –, intensity of intervention (e.g., number of contacts in both intervention and control arms, number of contacts with physician), intervention latency (i.e., average duration from screening invite to screening behaviour). However, there was insufficient amount of reliable data reported in the included studies on these variables to conduct moderator analyses suitably. For instance, only one study (comprising of four cluster-randomised controlled trials assessed in parallel), conducted by Wardle and colleagues (2016), reported whether each participant was being invited for the first time (prevalent first-time episode), being sent a screening invitation having previously not responded (prevalent episode), or being sent a screening invitation having been screened before (incident episode). Screening history variables such as this have been noted as important factors to take into account when examining CRC screening uptake (Raine, Moss, et al., 2016; Steele et al., 2010) and their consistent reporting would have allowed for their inclusion in analysis in order to provide more specific recommendations about *how* health interventions should be designed and for *which* populations.

There was also a considerable amount of variability within some of the moderator categories. For instance, with regard to intervention materials, ‘paper-based media’ consisted of many different types of print materials, that are likely to have also differed substantially in terms of their content. Additionally, some of the categories were combined – for example studies that used both electronic- and paper-based media were combined with studies only using electronic-based media and the combination of these into one category, allowed for conducting robust and adequately-powered moderator analyses. However, in the aforementioned example, although it is evident that studies using electronic-based media are effective overall, it is unclear whether this effect is observable due to a synergistic

action with print materials or because one type of materials acted in isolation to increase intervention effectiveness. This meta-analysis restricted its scope to RCTs and cluster-RCTs, which might be considered by some authors as limiting, however, applying this inclusion criterion enabled the focus of this review to be placed on the best available, experimental evidence for the purposes of evaluating intervention effectiveness to increase CRC screening uptake.

Objective measures of SES were often not reported, which increases the likelihood for miscategorising studies into *low* and *non-low SES* studies. The risk of this miscategorisation occurring was considered higher for studies classified as *non-low SES* studies, because the studies that targeted underserved populations all clearly specified that the intervention was targeting either low-income, ethnic minority or medically underserved populations. Study definitions of socioeconomic deprivation were varied possibly leading to the inclusion of studies in the review that operationalised socioeconomic disadvantage differently. It is possible that the *low SES* variables used to classify studies in this review are only a proxy for other indicators of deprivation. The lack of a clear definition for *low SES* studies was mainly due to papers rarely reporting objective indicators of SES uniformly. The reporting of objective measures of SES or other social determinants of health – including race/ethnicity, occupation, religion, education and socioeconomic position - might be particularly important for identifying and implementing interventions that will be effective in improving CRC screening, and broader health outcomes in general, among marginalised and socioeconomically disadvantaged populations. Currently, race-based and income-based categorisations are becoming obsolete, mainly due to the fact that, culturally and historically, such segregations have commonly led to unjust discriminations against certain populations. However, recognising and tracking social group differences in health has helped identify subgroups to whom additional resources need to be directed and is important for monitoring the state of health inequities at a societal level (Arcaya, Arcaya, & Subramanian, 2015). Objective SES indicators in studies could help distinguish both certain participant characteristics that might be related to intervention effectiveness, as well as certain intervention features that are associated with increased effectiveness among specific populations. An ongoing challenge for future research is deciding whether it is better to examine intervention

effectiveness on screening inequalities across individuals within a single population (e.g., high and low SES populations within a single country), or to focus on describing group-level differences across an entire population. Another difficult question that remains unanswered, is whether public health research should focus on improving screening uptake for the *worst-off* groups - in order to eliminate health disparities - or for the *largest* groups - in order to improve overall population health and reduce the prevalence of CRC. For instance, should prevention interventions target screening uptake among ethnic minorities and not among whites, or should the aim be for CRC screening uptake to increase in both groups?

Significant statistical heterogeneity remained even after extensive moderator analyses. This was mainly due to the breadth of the current research topic and the multiple, differing perspectives it contains. Despite the substantial exploration of this heterogeneity, across all subgroup analyses the indices available for measuring heterogeneity seldom reached statistically acceptable levels. This is not surprising given that even after analysing intervention effectiveness by specific subgroups, interventions to increase CRC screening uptake were still largely variable across multiple domains, some of which were known to the researchers – for example, studies differed with respect to the BCTs used, the strategy used to incorporate theory into intervention development, the study setting, location etc. – as well as unknown variables. For instance, the direct or indirect effect of having a private or universal health coverage system could not be examined within the current meta-analysis, but is known to affect the delivery of health services (including cancer screening services), overall health system performance, and can impact on health inequalities (Asaria et al., 2016; Baum, 2016; Boerma et al., 2014; Frenk, 2015). A final limitation, is that due to the breadth of the research and the high number of studies identified in the literature, there was an inevitable delay between the database searches carried out (last search October 2016) and the reporting of the findings.

2.4.8. Conclusions

In summary, the present meta-analysis identifies intervention approaches drawn from all the available randomised evidence, and provides an evidentiary basis on which future public health interventions aiming to increase CRC screening

can be developed. It is important that future trials provide detailed accounts of intervention descriptions in order to establish the relative effectiveness of the various intervention components and build on existing evidence. Additional rigorous and generalisable studies that target both ‘downstream’ (e.g., cancer screening services) as well as ‘upstream’ determinants of health (e.g., policy change, poor living conditions) are urgently needed in order to examine their capacity to reduce the pervasive problem of CRC screening disparities. The practical significance of the present findings as well as the recommendations for future interventions based on the trends observed in the review, are discussed in further detail in the Discussion chapter of the present thesis.

CHAPTER 3

Exploring the Determinants of gFOBT Screening Uptake among an Ethnically and Socioeconomically Diverse Population (Study 2)

3.1. Introduction

The systematic review and meta-analysis in Chapter 2 examined the effectiveness of public health interventions to improve CRC screening rates by level of SES and identified a range of variables, including BCTs, which acted as moderators of intervention effectiveness. Promisingly, the findings suggested that health interventions led to a more than two-fold increase in uptake among low SES populations, thereby contributing to the reduction of inequalities observed in CRC screening uptake. Yet, despite the significant reduction observed, the difference in screening uptake rates in the low and high SES groups remains alarming, indicating that a more in-depth exploration of the factors that affect screening participation, and how these manifest among different subgroups of the population, is crucial in order to achieve a high level of screening participation across the overall population but also to effectively reduce screening disparities through future interventions. At the same time, the majority of studies included in the meta-analysis were conducted in the USA and due to system-level differences in the delivery of healthcare between the USA and the UK, it was considered important to further examine the individual, contextual and cultural influences on screening behaviour in a UK-specific context. The primary difference compared to the UK, is that in the USA screening remains predominantly opportunistic and requires people to either pay or be reimbursed from their health insurance provider, therefore is often associated with financial barriers (e.g., inability to acquire health insurance, inadequate insurance coverage, lack of regular source of care) that contribute to screening nonparticipation particularly among socioeconomically disadvantaged populations (Beydoun & Beydoun, 2008; Klabunde et al., 2011). Due to the differences in the delivery of screening services in the USA and the UK the evidence from the meta-analysis, although informative, cannot be directly applied to the UK context. As discussed earlier in the thesis, despite screening being offered free at the point of care in the UK, screening inequalities are evident in the

UK (Blanks et al., 2015; Lo, Waller, Wardle, & von Wagner, 2013; Von Wagner, Baio, et al., 2011), as well as in other countries with universal healthcare that have developed structured screening programmes such as Spain (Hurtado et al., 2015), Italy (Carrozzi et al., 2015; Turrin et al., 2015), the Netherlands (Deutekom et al., 2009), Denmark (Frederiksen, Jørgensen, Brasso, Holten, & Osler, 2010) and Canada (Decker, Demers, Nugent, Biswanger, & Singh, 2015; Honein-AbouHaidar et al., 2013), suggesting that the observed inequalities are caused by factors that are not purely economic in nature (e.g., income, financial deprivation) but are also influenced by other aspects of socioeconomic disadvantage or vulnerability (e.g., age, gender, ethnicity, marital status, education), as well as psychosocial factors, including emotional state, sociocultural environment, previous experience of illness, perceived health status and understanding of illness.

Several studies have identified factors that may motivate or deter individuals from participating in bowel cancer screening. Non-participation in screening has been attributed to lack of knowledge (Berkowitz, Hawkins, Peipins, White, & Nadel, 2008; Clarke, Gallagher, Kearney, McNamara, & Sharp, 2016; Gimeno-García, Quintero, Nicolás-Pérez, & Jiménez-Sosa, 2011; Hoffman-Goetz, Thomson, & Donelle, 2008; O'Sullivan & Orbell, 2004), embarrassment (Bridou et al., 2013), cancer fatalism (Chapple, Ziebland, Hewitson, & McPherson, 2008; Goldsmith & Chiaro, 2008; Miles, Rainbow, & von Wagner, 2011) and anxiety about screening results (Beeker, Kraft, Southwell, & Jorgensen, 2000; O'Sullivan et al., 2004). A more recent focus group study conducted with participants from a variety of socioeconomic backgrounds in the UK (Palmer, Thomas, Von Wagner, & Raine, 2014) highlighted the important role emotional barriers play in screening uptake, such as affective risk perception and feelings of disgust and shame. Other research suggests that the fact that bowel cancer and faeces are widely perceived as taboo topics within the wider societal context, and the lack of cultural openness in discussing bowel-related issues, are also factors that negatively affect screening participation (Beeker et al., 2000; MacKenzie, Chapman, McGeechan, & Holding, 2010). Decisions to not participate in cancer have also been associated with forgetfulness, lower perceived susceptibility, lack of cancer symptomatology and low perceived self-efficacy (Berkowitz et al., 2008; Hall et al., 2015; Hoffman-Goetz et al., 2008; Szczepura et al., 2003).

Apart from the aforementioned barriers, populations with historically lower screening uptake, such as BAME and low SES populations, experience additional barriers, including low health literacy, low level of acculturation, low levels of education, language-related difficulties and poor patient-physician communication (Gimeno Garcia, 2012; Kobayashi et al., 2014; Power et al., 2009; Solmi et al., 2015). On the other hand, knowing someone with cancer (Lobchuk et al., 2012; Molina-Barceló, Salas Trejo, Peiró-Pérez, & Málaga López, 2011; Oster et al., 2013), social support (Brouse et al., 2003; Dolan et al., 2004; Rogers, Mitchell, Franta, Foster, & Shires, 2017; Schoenberg et al., 2016; Wardle et al., 2004) and the perception that screening is effective in reducing disease threat (Javanparast et al., 2010), are factors that have been found to increase bowel cancer screening uptake.

Acceptability of the test has also been highlighted as a critical factor predicting screening participation, with evidence suggesting that people are more likely to complete a test they prefer and perceive as hygienic and convenient (Marshall, McGregor, & Currie, 2010). Recent data have suggested that commonly reported barriers, relating to concerns about hygiene and the collection of faecal matter, may be overcome with the introduction of the FIT. As indicated earlier in the thesis, the replacement of the gFOBT by the FIT was announced by Public Health England in June 2016 and unlike other national screening programmes, which adopted a phased implementation approach (e.g., Scottish Bowel Cancer Screening Programme, Dutch Bowel Cancer Screening Programme), the English BCSP has announced that all of the five regional programme hubs will switch to using the FIT simultaneously in 2018.

The main differences between the FIT and the gFOBT is that the latter requires a total of six faecal samples to be collected (two samples from three separate bowel movements), whereas the FIT requires one sample to be collected on a single occasion. Apart from greater service user acceptance (Hol et al., 2010), the FIT offers several advantages over gFOBT, including more consistent detection of advanced adenomas and precancerous lesions, not being affected by dietary choices and medication, and higher sensitivity to a lower concentration of human haemoglobin (Hb) within a single faecal sample (Goede et al., 2017; Rabeneck et al., 2012).

Recent UK-based data have shown promising findings with regards to the acceptance of the FIT. For instance, a recent survey (Chambers et al., 2016) reported that individuals showed higher intention to complete and return the FIT compared to the gFOBT and perceived the FIT as less disgust-provoking and easier to complete. Similarly, data from a large, comparative pilot study that was performed within the English BCSP in 2014, suggested markedly improved participation rates with the FIT compared to the gFOBT (Moss et al., 2016). Use of the FIT resulted in a 7% increase in overall screening uptake (66.4% vs 59.3%) and almost doubled screening participation among groups with traditionally low screening participation rates, such as ethnic minority populations, men and people living in areas of greater socioeconomic deprivation (FIT 23.9% vs gFOBT 12.5%). Currently, there is little qualitative research that has examined whether a one-sample test is preferable to a three-sample test and whether this is a factor that might be weighted in the decision-making process of different populations. Moreover, despite some UK-based, empirical, qualitative evidence (Dharni, Armstrong, Chung-Faye, & Wright, 2017) there is a paucity of studies that have assessed the views towards gFOBT by involving participants from both BAME and White British backgrounds, men and women, screeners and non-screeners, and participants representing varying degrees of socioeconomic deprivation within one study sample. Overall, the extent to which some of the psychosocial determinants of screening indicated earlier (e.g., avoidance, lower perceiver risk, fatalistic beliefs) map onto sociodemographic determinants of bowel cancer screening uptake (e.g., ethnic background, SES) remains largely underinvestigated.

Therefore, the aim of this study was to conduct a series of one-to-one, semi-structured interviews with a sufficiently diverse sample to enable the investigation of ethnicity, SES, screening history, gender and other psychological variables in the same analysis and gain better insights into the succeeding decisional process toward screening behaviour. Specifically, the four objectives of the present research were, *firstly*, to draw upon participants' perspectives and lived screening experiences to ascertain that factors that influence gFOBT screening uptake; *secondly*, to identify which psychosocial determinants promote or inhibit screening participation and whether these differ between different subgroups of the population; *thirdly*, to provide suggestions that inform the development of health

interventions to promote screening uptake, with an emphasis on providing suggestions for specific subgroups in which participation is particularly low; and *fourthly*, to collect some preliminary qualitative data on participants' attitudes towards the FIT. The findings of this study build the foundation for the following study (Study 3), which will quantitatively investigate the relationship between psychosocial and sociodemographic predictors of CRC screening intention.

3.2. Method

3.2.1. Participants and Recruitment

Participants were eligible for inclusion if they were aged between 60 and 74 years, lived in Leeds, had received a prior invitation from the NHS to take part in bowel cancer screening and did not have prior personal history of bowel cancer or other chronic gastrointestinal disorders, including IBD (i.e., including ulcerative colitis and Crohn's disease) and Irritable Bowel Syndrome (IBS). Participants were recruited by the researcher through charitable and voluntary organisations in inner-city areas of Leeds, local community groups, online and poster advertising (see Appendix 3.1. for research poster) and through word-of-mouth over a period of seven months (February to September 2016). The recruitment strategy was shaped by the study objective to examine the psychosocial determinants of gFOBT screening uptake in a way that would ensure comparability across diverse populations. Specifically, there were four dimensions expected to directly influence screening participation and these were designated *a priori* through consultation of the existing bowel cancer screening literature. These dimensions were: (1) participants' ethnic/racial background, with participants being classified as having a White British ethnic background or BAME background; (2) participants' gender; (3) participants' screening history, where interviewees were categorised into those that had completed the gFOBT at an earlier invitation and those who had not, and (4) participants' SES, which was based on the Index of Multiple Deprivation 2015[16] (IMD2015; Smith et al., 2015), which is a measure that provides area-level deprivation data based on participants' postcodes. Specifically, the IMD2015

[16] The IMD measures relative levels of deprivation in small areas of England known as Lower Layer Super Output Areas (LSOAs). Each LSOA is appraised against 38 separate indicators across seven

provides a relative score of overall deprivation based on seven domains: (1) income deprivation; (2) employment deprivation; (3) education, skills and training deprivation; (4) health deprivation and disability; (5) crime; (6) barriers to housing and services and (7) living environment deprivation. Participants were classified into two groups, those living in neighbourhoods with high socioeconomic deprivation – that is, quintiles 1 and 2 of the IMD2015 – and those living in areas of moderate or low socioeconomic deprivation – that is, quintiles 3, 4 and 5 of the IMD2015.

A purposeful sampling approach was adopted in order to facilitate the identification and selection of participants that were aligned with the objectives of the research. Specifically a maximum variation sampling (MVS) approach was adopted, which is a strategy that aims to sample for heterogeneity thereby documenting people's unique or diverse experiences with the phenomenon of interest. MVS is commonly employed in qualitative research in order to achieve a depth of understanding whilst ensuring representativeness and diversity of participants (Patton, 2005). To facilitate the purposeful selection of participants, a sampling grid approach was used to direct the recruitment process, which, according to previous research (Patton, 2002; Suri, 2011), ensures that participants are selected in a systematic way and that the sample of participants is well-suited for the purposes of the research project. For instance, as seen in Table 3.1., there was a proportional number of males and females, past screeners and past non-screeners, people from BAME and White British ethnic backgrounds as wells as people from areas with higher and lower SES, who participated in the present research.

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domains. A deprivation index is provided for each domain, but the domains are also weighted to derive a total IMD score, which reflects the extent of deprivation in any given area.

Table 3. 1 Recruitment Sampling Grid

Characteristics of population (n = 27)	Male screeners	Male non-screeners	Female screeners	Female non-screeners
White British, IMD quintiles 3, 4, & 5	-	*1*	*7*	*1*
White British, IMD quintiles 1 & 2	-	-	*3*	*1*
Ethnic minority, IMD quintiles 3, 4, & 5	*3*	*3*	-	*1*
Ethnic minority, IMD quintiles 1 & 2	*2*	*4*	-	*1*

Note. IMD quintile categories are based on national cutoffs; IMD quintile 1 = most deprived and quintile 5 = least deprived.

3.2.2. Procedure

To explore the determinants of bowel cancer screening uptake, a qualitative research method was employed, using semi-structured, one-to-one interviews. Semi-structured interviews were used, over unstructured or structured interviews, because it is widely accepted that they provide increased flexibility to both the interviewer and the respondent, whilst ensuring that the same general areas of information are collected from each interviewee (Bernard, Wutich, & Ryan, 2016; McNamara, 2009). An additional benefit of semi-structured interviewing is that it enables researchers to capture data more effectively due to the researcher firstly, maintaining the liberty to improvise additional questions related to the central question, and secondly, being able to provide additional commentary to clarify potentially ambiguous participant responses (Jamshed, 2014).

In the present study semi-structured interviews enabled the exploration of factors that influence people's decision-making process with regards to gFOBT screening. An interview schedule was developed and informed by the findings of the literature review and meta-analysis (Chapters 1 and 2), as well as through discussions with public health specialists and health and research psychologists at the University of Leeds. The interview schedule was extensively discussed with a

cancer improvement specialist and was piloted through a single interview with a member of the community who met all inclusion criteria. Minor adaptations were made to reflect the feedback from the health specialist and a few questions were modified to facilitate clarity as a result of the pilot interview.

A one-to-one interviewing method was chosen in order to obtain people's individual accounts and experiences with regards to gFOBT screening. Given that stool-based screening procedures have been paired with experiencing negative affects, including embarrassment, disgust, anxiety and fear (Consedine, Ladwig, Reddig, & Broadbent, 2011; O'Carroll et al., 2015), one-to-one interviewing was deemed preferable over focus group interviewing in which participants might have been more reluctant to openly discuss personal, and perhaps sensitive, issues relating to their screening experiences. Moreover, findings from focus-group research are more likely to be influenced by groupthink bias, which has been recognised as a common disadvantage of focus group research (Dimitroff, Schmidt, & Bond, 2005).

In the first instance, participants were approached through local community centres and charitable organisations (e.g. Feelgood Factor, Barca, Women's Health Matters, Black Health Initiative) across Leeds. Appropriate permission from each community centre/charitable organisation was obtained to place posters advertising the study on relevant notice boards in public spaces within each organisation. Additionally, the researcher arranged with organisation stakeholders to attend sessions that community centres/charitable organisations organised for their members to make an announcement about the study (i.e., outline the rationale and aims of the research). Prior to the commencement of the interview participants were provided with a participant information sheet (see Appendix 3.2.) and were given the opportunity to ask questions before providing written informed consent (see Appendix 3.3.). Additionally, each participant was verbally reminded about the aims of the study, the open-ended conversational style of the interview, the audio-recording requirement for transcription, confidentiality policies and the right to withdraw from the study up until one month after the interview. As part of the recruitment process, participants were asked to fill in a brief, pre-screening demographic questionnaire (Appendix 3.4.) to determine their eligibility to take part in the research. The pre-screening questionnaire was also used to inform

subsequent recruitment, in line with the purpose and scope of this research, by indicating whether cells within the aforementioned sampling grid were overpopulated or underpopulated. For instance, during the initial stages of recruitment it was apparent that there was an increased number of participants from a White British ethnic background and female screeners with high SES, suggesting an adequate representation of this group within the dataset but a need for increasing the number of cases within the remaining cells.

The interview schedule comprised of pre-set, open-ended questions and topic areas that were explored by the researcher during interviews (See Appendix 3.5. for the interview schedule). Participants were encouraged to share their opinions and experiences on cancer screening using the gFOBT kit and the factors they felt influenced their decision-making processes across the cancer screening pathway. Questions touched upon participants' knowledge about bowel cancer and the screening process (e.g., "What do you know about the bowel screening kit?"), past screening experiences with using the bowel screening kit (e.g., "Did you experience any issues you would like to mention when you used your screening kit?"), opinions and feelings relating to the screening process in the context of their own lives (e.g., "How did you feel about collecting stool samples?"), as well as suggestions of how the process could be improved (e.g., "What do you think would increase the chances of you using your kit next time?"). Discussions were further facilitated by bringing an unused, demo screening kit to the interview (see Appendix 3.6. for a picture of the kit) as it was anticipated that it might act as a prompt and encourage participants to share more information and/or lead to the revelation of new information with regards to participants' experiences using the kit. For non-screeners, it was expected that the presence of the kit might positively influence attitudes towards the screening process, possibly by giving them the opportunity to engage in open discussion about bowel screening in a non-judgmental and safe conversational space. On completion of the interview, participants were debriefed and were given the opportunity to ask questions or share any additional comments. For any clinical questions, relating to bowel cancer and the screening process, participants were directed to the NHS webpage about bowel cancer and were given the helpline number that addresses general queries about bowel cancer and screening. Participants were also given the standard NHS

leaflet, which provides detailed information regarding the gFOBT screening process.

All interviews took place between February 2016 and October 2016. Nineteen interviews were conducted at inner-city community centres in the areas of Chapeltown, Harehills and Woodhouse and eight interviews were conducted at the School of Psychology at the University of Leeds. Interview times ranged from 17 to 62 minutes (M = 31, SD = 13.4). Participants were asked whether the research team could keep a record of their contact details to be contacted for future research projects on bowel cancer screening. Participants were given £5 cash to reimburse them for their time and travel expenses. Interviews were audio-recorded with participants' permission and were transcribed verbatim. Audio recordings were stored as password-protected files on a University of Leeds computer. Any personally identifiable information (such as names and addresses) were removed from the transcript to ensure the anonymity of each participant and each transcript was assigned a unique identification code known only to the researcher. The completed consent forms, participants' unique identification codes and anonymised transcript data were kept in locked cabinets within the University of Leeds campus facilities.

3.2.3. Method of Analysis

A thematic analysis methodology was adopted using the guidelines set forth by Braun and Clarke (2006). Thematic analysis is a method for systematically organising, identifying and synthesising qualitative data into relatively broad patterns of meaning, commonly referred to as *themes*, which aim to reflect the content of the entirety of the data (Gbrich, 2012). Thematic analysis was chosen over other qualitative methods because, unlike discourse analysis, conversation analysis or grounded theory analysis, it is a theoretically flexible methodology. In addition, thematic analysis is not characterised by strong theoretical perspectives that drive the analytical process, which enables its use within different frameworks that are free from strict philosophical postulates and/or epistemological conventions. Due to its 'broad-brush' analytical identity it is commonly used in research that aims to understand a particular phenomenon from the perspective of those experiencing it, which is achieved through analysing textual, narrative

information that reflects people's life stories, opinions and perceptions. It is therefore broadly perceived as a predominantly descriptive method, without however lacking the interpretative depth that is required to extract meaningful research findings (Vaismoradi, Turunen, & Bondas, 2013). To date, the analytical framework proposed by Braun and Clarke is considered to be the most rigorous and systematic approach for thematic analysis currently available (Howitt & Cramer, 2010). The main processes involved in thematic analysis are data familiarisation, data coding, data recoding and theme development, however, the analytic process is not linear, simply progressing from one stage to the next, rather the analytic process is circular and requires frequent reviews (Clarke & Braun, 2014).

According to Braun and Clarke's model there are six stages involved in the process of analysing qualitative data; in the *first* stage the researcher becomes familiar with the data, which is achieved both during the phase of transcription but also by reading the transcript several times; the *second* stage involves the generation of initial codings, which in turn informs the development of broader themes during the later stages of the analysis. This process involves the labeling of brief units of analysis within the transcript – usually composed of a line or two of textual data –, which aim to capture what was said in the interview as closely as possible. It is critical that the initial codings provide an accurate reflection of the data so that these can be translated into conceptually meaningful themes during stage *three* of the analysis. The *fourth* stage involves checking the previously generated themes against the coded extracts and the original dataset, whilst the *fifth* stage involves further developing the themes by revisiting the data and assessing whether the themes are conceptually unique and distinguishable from all the other themes. This stage also involves generating and assigning theme labels that accurately reflect each theme. The final and *sixth* stage relates to synthesising the final report. This involves providing a detailed description of all the previous analytic stages involved in the research and relating all the stages back to each other. In thematic analysis, the final stage also constitutes the last opportunity for data analysis as researchers may be inclined to reformulate the research question in light of complications that arise during the process of writing-up. The six stages of thematic analysis are visualised in Figure 3.1.

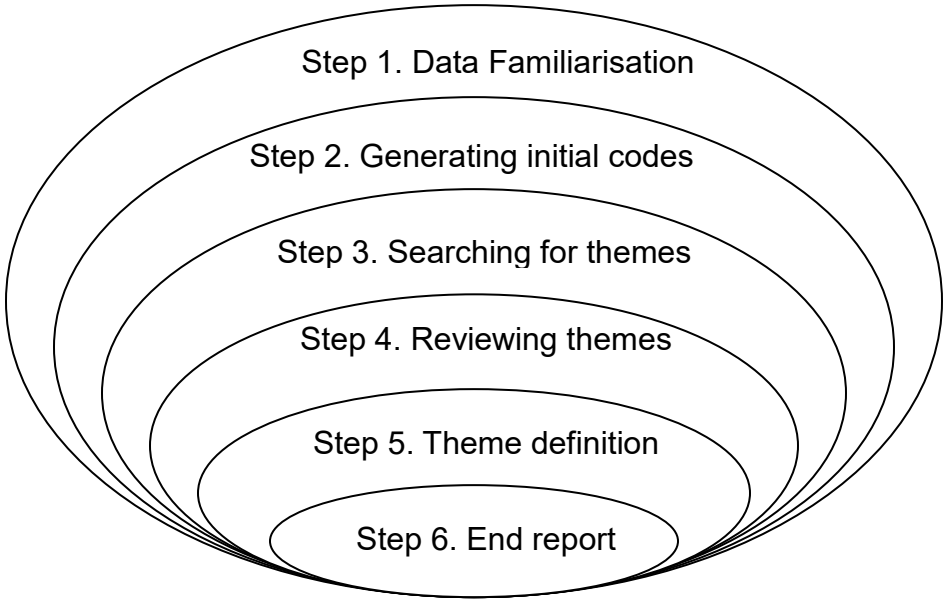


Figure 3. 1. A visualisation of Braun and Clarke's model of thematic analysis. Adapted from Howitt (2016, p.169).

The interviews were transcribed *verbatim* (i.e., word for word) using direct and literal transcription methods. It was not deemed necessary to include the conventions of dialogue transcriptions because the content of the interviews was of primary interest. During the transcription stage initial thoughts and ideas were recorded (i.e., codes). The transcribed data were revisited several times and also interview recordings were listened to a second time, to ensure transcription accuracy. The initial codes consisted of words or short phrases that described the transcribed data at an abstractive level - that is, the codes corresponded to features of the data that were considered pertinent to the research question but involved the minimum amount of interpretation, as per the recommendation by Braun and Clarke (2006) during this early stage of analysis. The codes identified during this stage were recorded using Microsoft Excel as an analytic database, and each code was accompanied by all the corresponding representative quotations identified through the transcripts.

Following on from the stages of data familiarisation and the generation of initial codes, was the stage of searching for themes based on the initial codings. Codings were initially grouped into sub-themes on the basis of similarity. These

sub-themes explained larger sections of the data and embraced a number of the initial codes that were identified as being conceptually alike. Sub-themes were subsequently organised into higher order themes, and in turn, themes were organised into overarching thematic clusters. Themes were repeatedly reviewed throughout the analytic process and any that were too multifarious, or that did not have enough transcript extracts to support them, were discarded. The refinement of each theme was achieved both by assessing each individual theme for its conceptual coherence, but also by considering each formed theme in relation to all the other themes and sub-themes within the dataset. This process was aided through the use of thematic maps; an approach also recommended by Braun and Clarke (2006), in order to envisage the associations and potential interconnections between themes. After reviewing and refining the themes, the entire dataset was re-read and further coding took place to ensure that any additional data relating to a theme - which could have been missed during the initial coding phase - was coded and incorporated into the analysis. After the themes were reviewed and refined, analysis moved to stage five, which involved the definition of themes and labeling. Labels of themes were carefully considered on the basis of how well they conveyed an instantaneous indication of the essence of the theme. The final stage of the report production also involved choosing compelling extract examples to illustrate essential theme features.

3.2.3.1. Theoretical and Epistemological Approach

In the current study, an inductive – also referred to as 'bottom-up' - method was used to identify themes within the data. An inductive thematic analysis procedure postulates that the themes identified are predominantly data-driven, as opposed to the deductive approach where themes and codes are determined by the researcher's pre-existing interest in previous theories (also referred to as analyst-driven or theoretical thematic analysis; Braun & Clarke, 2006; Hayes, 1997; Patton, 1990). An inductive analytical approach was selected because the research question was broad and the research also aimed to explore multiple secondary research questions. Furthermore, little previous research has focused on the differential experiences of men and women, screeners and non-screeners, BAME and non-BAME populations and high and low SES populations within the context of bowel cancer screening, and particularly gFOBT screening. Additionally,

this research was exploratory in nature, in that it examined the synergistic interplay between ethnicity, gender, SES and past screening history to determine variation in the self-perceived barriers and facilitators to gFOBT screening; therefore a deductive approach would have been limiting and unfit for the purposes of the current research.

A further decision was made relating to the 'level' at which themes were identified - Boyatzis (1998) has proposed two levels; firstly, a semantic or explicit level, whereby themes are detected at the surface - or "semantic appearance" - of the data. In this case, the analyst is not in the pursuit of examining any underlying ideas, assumptions and/or conceptualisations that shape the semantic content of the data. The second level is known as the latent or interpretative level, which requires the analyst to go to a level of analysis deeper than the superficial features of the data. In the present study, themes were identified at the semantic level rather than on a latent level. The rationale behind this choice is that latent thematic analysis traditionally results from a constructionist paradigm rather than the essentialist or realist paradigm in which the present research was situated. Braun and Clarke (2006) suggest, that latent thematic analysis overlaps, to a certain extent, with discourse analysis; an analytical approach that has been coined as 'thematic discourse analysis'. Thematic discourse analysis has strong influences from psychoanalytic models of interpretation, where broader assumptions, ideas and/or meanings are thought to be underpinning what is actually articulated in the data. In the present research the aim was to interpret the data solely on what was said by participants during the interview and to organise the data into patterns of semantic content. Therefore, a semantic analytic process, which requires the gradual progression from the *description* to the *interpretation* of the data, was considered to be better suited.

The epistemological approach adopted for the present research was situated within the essentialist/realist paradigm, which represents one of the two main epistemologies found in thematic analysis (the other is the constructionist paradigm). From the essentialist/realist perspective an individual's motivations and experiences are interpreted without taking into consideration the sociocultural context of the individual, rather a unidirectional, straightforward association is assumed between experience and language – that is, language directly reflects

and enables us to articulate meaning and experience (Braun & Clarke, 2006; Potter & Wetherell, 1987; Widdicombe & Wooffitt, 1995).

3.2.4. Quality Appraisal

The quality of the present research was assessed using a critical appraisal tool for interview studies proposed by Leonidaki (2015). Leonidaki's tool was developed primarily for assessing the quality of interview-based studies exploring clients' experiences with psychodynamic psychotherapy, however, the tool was subsequently adapted to broaden its scope and make it applicable to other interview studies in psychological research, including health, forensic, education and organisational psychology. The tool aims to assess interview studies across nine different domains: (1) Context and Purpose; (2) Recruitment; (3) Situating the Sample; (4) Data Collection; (5) Analysis and Findings; (6) Auditability/Credibility; (7) Impact and Value; (8) Reflexivity and (9) Ethics. Each domain consists of different criteria, which evaluate distinct elements of the study; if the study provides sufficient evidence to meet a criterion then it is scored positively (+) and if it does not it is scored negatively (-). Some criteria can be judged as being non-applicable (N/A). Leonidaki further proposes calculating a total score; studies scoring between 0-0.45, 0.46-0.69 and above 0.70 are classified as having poor, fair and high quality. The present study had a total score of 0.73, which reflects good overall quality of the study. See Appendix 3.7 for the detailed scoring of each appraisal criterion included in the critical appraisal tool.

3.2.5. Ethics

Ethical approval for the study was granted by the School of Psychology Research Ethics Committee at the University of Leeds (Reference Number: 16-0022; Date of Approval: 04/02/2016).

3.3. Results

3.3.1. Sample Characteristics

Interviews were conducted with 27 participants. The sample composed of almost an equal split between men (48.1%) and women (51.9%). Similarly, there was a balanced analogy between participants from a White British ethnic background (48.1%) and participants from a BAME background (51.9%); the latter group included participants from Black Caribbean, Indian, Pakistani, Bangladeshi,

Iranian, Albanian, Cypriot, German and Greek ethnic backgrounds. Approximately half of the sample (55.6%) spoke English at home as their primary language. The majority of participants (77.8%) did not report having a family history of bowel cancer. All the participants had been sent a screening invitation and kit from the NHSBCSP, with the majority (70.4%) having screened at least once in the past. Approximately half of study participants (48.1%) were not up to date with bowel cancer screening at the time of the interview. Descriptive data for all participants are shown in Table 3.2 below.

Table 3. 2. Sociodemographic and screening history characteristics of study participants

Characteristics	**N**	**%**	**P**
Total participants	27	100	
Gender			
Male	13	48.1%	P7, P11, P16-P17, P19-P27
Female	14	51.9%	P1-P6, P8-P10, P12-P15, P18
Age			
60-67	12	44.4%	P1, P3-P4, P6, P8, P10, P12, P14-P15, P18, P21, P26
68-74	15	55.6%	P2, P5, P7, P9, P11, P13, P16-P17, P19-P20, P22-P25, P27
Ethnicity			
White British	13	48.1%	P1-P8, P10, P12, P14-P15, P18
BAME[a]	14	51.9%	P9, P11, P13, P16-P17, P19-P27
Primary Language			
English	15	55.6%	P1-P10, P12, P14-P15, P18, P21
Other	12	44.4%	P11, P13, P16-P17, P19-P20, P22-P27
IMD Quintile[b]			
1 (most deprived)	10	37%	P1, P6, P9, P14, P17-P18, P20, P22, P26-P27
2	1	3.7%	P19
3	5	18.5%	P4, P10, P11, P12, P23
4	1	3.7%	P3
5 (least deprived)	10	37%	P2, P5, P7-P8, P13, P15-P16, P21, P24-P25
Family history of CRC			
Yes	6	22.2%	P1, P3-P4, P8-P9, P12
No	21	77.8%	P2, P5-P7, P10-P11, P13-P27
Screening episode			
Prevalent	8	29.6%	P11-P12, P16-P17, P22, P25-P27
Incident	19	70.4%	P1-P10, P13-P15, P18-P21, P23, P24
Up-to-date with screening			

Yes	14	51.9%	P1-P4, P6, P8, P10, P14-P15, P19-P21, P23-P24
No	13	48.1%	P5, P7, P9, P11-P13, P16-P18, P22, P25-P27

Notes. [a] Included Caribbean, Indian, Pakistani, Bangladeshi, Iranian, German, Cypriot, Albanian and Greek. [b]Quintiles were based on national cutoffs; areas in quintile 1 are among the most deprived 20% in England, whereas areas in quintile 5 represent the least deprived 20% in England. N = Number of participants. P = represents the participant in the study. IMD = Index of Multiple Deprivation.

3.4. Thematic Analysis

Three super-ordinate clusters emerged to describe the decisional process towards gFOBT screening behaviour among study participants: (1) '*Perceived barriers of screening'*, (2) '*Perceived facilitators of screening*' and (3) '*Participants' attitudes towards the FIT versus gFOBT'*. These clusters were identified not only because of their prevalence – that is, they appeared frequently within the dataset and were salient for the majority of participants - but also because they were directly relevant to addressing the main research questions, which were:

1. What are a) the perceived barriers and b) the perceived facilitators of gFOBT screening uptake, and do these differ by variation in ethnicity/race, socioeconomic deprivation, gender and past screening behaviour?
2. What are participants' views on the one-sample screening test (i.e., FIT) versus the three-sample screening test (i.e., gFOBT)?

The main clusters, themes and sub-themes are discussed below, and have been organised to address the research questions in the order listed above. Indicative excerpts from the interview transcripts are used to illustrate the themes, which emerged from the data. The three clusters, each consisting of multiple themes and subthemes as well as the frequency of each sub-theme is shown in Table 3.3.

Table 3. 3. Overview of thematic analysis of factors affecting bowel cancer screening uptake

Cluster	Theme	Subtheme	Frequency[a]
Perceived barriers to gFOBT screening uptake	Bowel cancer stigma	It's taboo	20
		Cancer fatalism	10
		Feeling embarrassed	14
		Lack of open discussion	10

	Awareness, attitudes and beliefs	Lack of awareness	13
		Healthcare system distrust	4
	Inconvenient screening procedure	Procedural planning	12
		Lack of privacy	7
		Practical difficulties	14
	Ick factor	-	22
	Fear of cancer	Avoidance as a temporary salve	11
		The dreaded test result	8
		Treatment fears	8
	Gender and sociocultural influences	A gender issue	17
		Language barriers and health literacy	9
		Sociocultural environment	7
Perceived facilitators to gFOBT screening uptake	Social influences	General social support	15
		Spousal support	5
		Staying healthy for loved ones	7
	Helping oneself	-	23
	Increased awareness	Knowing someone with bowel cancer	8
		Being a repeat screener	10
	Grateful for NHS	-	11
	Positive attitudes	Health conscientiousness	13
		Past experiences with screening	9
Attitudes towards the FIT versus the gFOBT	I prefer the FIT	-	7
	I prefer the gFOBT	-	6

Note. [a]The number of participants who identified the theme.

3.4.1. Cluster 1 – Perceived Barriers to gFOBT Screening Uptake

This cluster encapsulates common obstacles that participants encountered in relation to bowel cancer screening using the gFOBT kit. All 27 participants cited the practical difficulties of screening as a key factor affecting their screening experience. The collection of stool samples, storing and sending the kit through the post, forgetfulness, lack of time and/or privacy were all identified as practical barriers. Throughout the interviews it became clear that the majority of participants also experienced emotional barriers, which were triggered as result of taking part in the screening, and included a number of negative affects, such as shame, fear, anxiety, disgust and vulnerability. The following six themes – each with multiple sub-themes – appeared essential in understanding the factors that inhibit bowel cancer screening participation: 'Bowel Cancer Stigma', 'Awareness, Attitudes and Beliefs', 'Inconvenient Screening Procedure', 'Ick Factor', 'Fear of Cancer' and 'Gender and Sociocultural Influences'. There were aspects of participants' accounts and understandings of the factors that inhibited screening participation that overlapped across these themes. Nevertheless, this overlap was seen as a good interpretation of attitudes and beliefs in general, which seldom consist of isolated ideas and concepts, rather they tend to be interrelated and act synergistically to influence behavioural outcomes.

3.4.1.1. Theme 1: Bowel Cancer Stigma

Findings from the majority of the interviews, irrespective of participants' gender, socioeconomic deprivation, screening history and ethnic background, suggested that bowel cancer is a stigmatised illness and stigmatisation of bowel cancer was recognised as a potential barrier to screening. The sub-themes of 'It's taboo', 'Cancer fatalism', 'Feeling embarrassed' and 'Lack of open discussion' were identified as key factors influencing screening uptake.

3.4.1.1.1. Sub-theme 1: It's Taboo

Participants recognised cancer in general as being a 'taboo' topic and indicated that bowel cancer in particular is a topic that people tend to be reticent to talk about openly. Discussing gut-related bodily functions in public was largely perceived by participants as inappropriate and described that they felt pressured to use euphemistic and roundabout ways in order to avoid using taboo words (e.g.,

‘using the restroom’ instead of *‘going to the toilet’*, *‘stool’* or *‘number two’* instead of *‘poo’)*

> *'There is a massive taboo, and that is cross-gender, talking about this, I mean most comedians make their living out of talking about farting. I mean Billy Connelly, he is famous about talking about bowel movement and everybody giggles nervously. They are pretending to giggle but they actually laugh nervously about this, and lots of films are made about people who go to say boyfriends, girlfriends, parents and then they use the bathroom inappropriately and all that. There has to be a joke or a pun intended to make us feel comfortable. So there is still this stigma, isn’t there?’*
> (P8, White British, female, screener, high SES)

> *'Just doing something like that.. The nature of what you have to do. Sorry I don’t really want to say the word you know (laughs). Not to you. You know what I mean, the action of doing that.'*
> (P20, Pakistani, male, screener, low SES)

Both participants that had and had not previously taken part in gFOBT screening, felt confident enough to talk about the screening process during the interview, however, expressed feeling hesitant to have a conversation about it with friends, family, and even their GP, as it was seen as an improper, unacceptable and an overall uncomfortable conversation to be having.

> *'The problem is you wouldn’t bring it up in the middle of a dinner party, you know. It’s not kind of.. Well ‘Do you know what I did last Tuesday? Let me tell you all about it’. I find it awkward and embarrassing. It’s not […] ‘I went down to the hospital and had a blood test today’. That probably has more chance of entering a conversation than ‘I did this poo test’. So in the strata of pleasant to unpleasant it’s fairly at the bottom in every respect.'*
> (P7, White British, male, non-screener, high SES)

Shyness as a dimension of personality was described as a factor that exacerbated the inhibition to talk about bowel screening.

> *‘But people are shy. To me, they are just shy. And I am too. It’s too personal to talk about with anybody and the test is a bit weird, and maybe shy people find it more hard even, who knows? I know many people that don’t want to have anything to do with their bodies, their bowels, they are even shy of doctors, even if their doctor tells them to lie down to examine them, they will resist and say ‘ah, no I don’t want to lie down’ (laughs). So, in a way it’s too personal to talk about with anyone really.’*
> (P25, Pakistani, male, non-screener, high SES)

It is worth noting that a number of female participants who had experience of other national screening programmes such as breast and cervical cancer screening, indicated that they felt more comfortable in discussing those screening procedures, compared to bowel screening. Women talked about there being more awareness-raising campaigns for those cancers but highlighted that there is a lack of similar campaigns for bowel cancer screening and that this may be due to the increased stigma associated with bowel cancer. Specifically, women referred to the Pink Ribbon Breast Cancer Screening campaign, which attracts significant media attention each year and talked about female role models and celebrities who have been publicly advocating for breast and cervical cancer screening. Female participants described feeling that population-based campaigns may promote greater levels of public awareness, which in turn encourages more people to engage in discussions about these issues. Apart from the lack of population-based campaigns for bowel cancer, participants also reported feeling that there were fewer important public figures championing for the cause or announcing their diagnosis of bowel cancer, and that overall there is smaller media presence from bowel cancer advocacy groups and little coverage of the National Bowel Cancer Screening Programme.

> *'Unlike lung cancer, ovarian, but more so for cervical and breast cancer you are talking about more intimate bodily functions, things that you can't or won't talk about openly. As British it's not in our mentality to share personal stuff, not in our culture. I think some cancers are talked about more openly in the media – you know for breast cancer with all the pink ribbon campaign for awareness etc. – you don't see that for bowel cancer. It's not a pleasant thing to think or talk about.* '
> (P5, White British, female, screener, high SES)

Indeed, this issue was also raised by one of the male participants who also noticed that bowel cancer received less attention in the media.

> *'Lots of women have breast cancer and cervical cancer screening – it is part of health to have TV advertisements and TV spots to tell people that it is better to let your doctor know, it is in your interest. For breast cancer for example you have much more publicity, they have events, they have ambassadors whereas with bowel? You don't hear as much. And I think every form of disease should have it's own campaign because, as I indicated, if you diagnose the disease early it is easier to treat it'*
> (P19, Cypriot, male, screener, low SES)

3.4.1.1.2. Sub-theme 2: Cancer Fatalism

Participants from all ethnic groups, irrespective of their socioeconomic deprivation, strongly equated cancer with death. For some, being screened for cancer was seen as exposing oneself to the possibility of receiving a diagnosis of a potentially deadly disease, which automatically triggered thoughts of their own mortality. Participants' mental representation of lethality seemed to be particularly influential in deciding whether or not to take part in bowel cancer screening, but exerted a differential effect depending on the person's screening history. For instance, for past non-screeners, the perception of cancer as a death sentence undermined compliance with screening recommendations, whereas for past screeners an antithetical pattern of findings was observed; the association between cancer and death not only did not discourage them from obtaining the screening rather it enhanced bowel cancer screening acceptance.

> *'Is it like 'what you don't see doesn't hurt you' kind of an attitude towards life and health? I have many friends that think that way, I mean I do it too and I hate that I do it, but sometimes it's just easier to not think about these things you know? Or if you know you are very healthy you don't worry as much. I think I would know if I had cancer to be honest.'*
> (P13, Pakistani, female, non-screener, high SES)

> *'The main benefit I think and the reason why I do it is that you can be diagnosed fairly early. And then hopefully you wouldn't go through horrible disease and it could be cured. I suppose with cancer, I have had friends with various cancers, you just hope it's diagnosed early enough to make sure that you don't die from it. And that's I suppose at the back of your head most of the time. You are preventing an illness that could kill you.'*
> (P10, White, British, screener, high SES)

Death-related cognitions were more prominent among people who had either received a false positive gFOBT result or among those who had witnessed a family member or close friend being diagnosed with cancer. One participant, who had received a positive gFOBT result and had successfully undergone a colonoscopy to remove precancerous polyps, mentioned that receiving an abnormal gFOBT result led to further motivation to adhere to screening recommendations in the future. Interestingly, experiencing a 'scare' was associated with a concern that biennial screening might allow too big a time interval between

screening episodes and the participant expressed a preference for having the screening offered on an annual basis instead:

> *'When I was told that now I am alright, this was after they removed the polyps […] they said 'We will call you back in two years time' and I said 'Why not in one year's time?' and the nurse said 'It is every two years'. They later sent me some kind of questionnaire to give my feedback and I said we should have it (i.e., screening) every year. I know that these things cost but imagine as I speak to you right now I have another polyp developing and I have to wait for another year and a half. I want to have it done more frequently'*
> (P19, White Cypriot, male, screener, low SES)

Participants seemed to make a stronger association between cancer and mortality if they had heard about deaths attributed to bowel cancer within their wider community. Indeed, it was more common for participants to recall stories about people in their local community – often younger than them - who had died from bowel cancer, and there was a lack of participants discussing about people who had been successfully treated. The lack of personal accounts of people that had successfully treated bowel cancer seemed to further strengthen the association between a cancer diagnosis and holding a fatalistic construal of cancer. In this first example, bowel cancer is discussed in a dramatical tone with emphasis being put placed on suffering and pain.

> *'I do know that it can be very painful. I know other people, a friend of mine, who was actually quite younger than me, died of bowel cancer. As did my mother's friend and both of them had excruciating stomach pain on the side, obviously where the tumors were.'*
> (P4, White, British, female, screener, high SES)

In the second example, another participant provides a strongly fatalistic statement, where bowel cancer is associated with a rapid and inevitable death.

> *'My grandmother literally got bowel cancer very quickly and died very quickly. So I think, people, might in their heads think it's pointless to do the screening because you are likely to die anyway? I know that's a common thought people have.'*
> (P8, White, British, female, screener, high SES)

Both of the preceding examples illustrate that there is a strong link between cancer and death in people's perception of the disease and the additional association between cancer and pain/suffering indicates a widespread negative discourse surrounding bowel cancer, which may be associated with a reduction in screening participation among people with more fatalistic views.

3.4.1.1.3. Sub-theme 3: Feeling Embarrassed

Discussions relating to feelings of embarrassment were among the most prevalent issues participants raised during the interviews. Thirteen participants in total described experiencing a degree of embarrassment during the screening process. Participants described the feeling of embarrassment as an almost instantaneous reaction to the test and this was regularly triggered by a strong aversion towards the nature of the screening kit, specifically the aspect involving the collection of stool samples.

> *'I don't want to do it, no. Just because it's dirty. It turns my stomach. Doing that and having to put it on a piece of card…ah! No! I can't even think of doing it. And I'm squeamish you see, from the start I kind of thought, nope this isn't for me, can't do it'*
> (P18, White British, Female, Non-screener, low SES)

Non-screeners expressed being taken aback by, what was described as, an unusual screening test and commonly described the screening process as 'bizarre', 'eccentric' and 'odd'.

> *'It seems a bit crazy to be honest. It seems such an eccentric thing to do. It seems odd. It's an odd thing to do, isn't it? Just the whole process is strange'*
> (P12, White British, female, non-screener, high SES)

One participant, who had received multiple screening invites in the past but had never opened the screening kit - and was therefore unaware of the steps involved in the screening process - thought of the procedure as off-putting and enough to deter people from taking part in the screening.

> *'I wouldn't have even thought about it, no honestly no chance I would have thought about doing it if we hadn't spoken about it now. It's just a bizarre and awkward thing to have to do, isn't it?*'
> (P17, German, male, non-screener, low SES)

One participant suggested that preparing people in advance for what to expect could be beneficial in that it could help prevent a sudden, negative reaction for when patients first receive the kit.

> *'Well for me, it is simply doing something outside what you normally do and something that you would be naturally inclined to do. And it is hard for people, especially this age, to ask them to do something so bizarre. Maybe they should prepare people for this test from the time they're 30 so that they are not so shocked when the time comes (laughs)'*
> (P17, German, Male, Non-screener, low SES)

Despite repugnance at the idea of collecting stool samples being expressed by the majority of participants, non-screeners appeared more reluctant to handle their own faeces and experienced stronger feelings of aversion, which in turn was paired with a blunted perception regarding the benefits of screening. Compared to women, men were more likely to describe the sampling process in negative terms and perceived it as a significant barrier to screening uptake. Male participants also expressed feeling more uncomfortable and self-conscious about discussing the screening process with the researcher – although, on occasion, women also felt apprehensive about talking about their screening experiences openly.

> *'It was overall difficult (i.e., collecting the stool sample). But it's more difficult talking about it with you. I don't really want to go into too much detail speaking with a young lady, sorry (laughs).'*
> (P7, White British, Male, Non-screener, high SES)

> *'Do you only take a bit then (laughs)? I mean even talking about it with you now – it's so awful (laughs). Couldn't they have come up with something better than this? I think I'd do it if the process were different, you know? But with this, I don't think I can. I have heard people moan about it, that said that it's best to have it done but they didn't say if they had actually done it or not.'*
> (P18, White British, Female, Non-screener, low SES)

It was also apparent from the data that discussion regarding defecation and bowel movements is culturally perceived as a particularly private and personal topic and is treated as an 'act' that needs to be concealed. The example below illustrates that, societally, defecation functions as a taboo - more so than other bodily functions including urination or female menstruation.

> *'Actually, if you think of the whole process of going to the toilet – I never thought I would be sat talking to someone like you about going to the toilet – but the whole process is something predicated about not seeing anything. If you think about the action of what you do – you sit on the toilet, read your newspaper, and you flush the toilet – job done. Um, so you know, it isn't something you engage with. And I mean it's even more personal than urinating or women's periods. I don't know really. And that's why I find it so horrible, and actually shall we just change the subject? (laughs)'*
> (P7, White British, Male, Non-screener, High SES)

3.4.1.1.4. Sub-theme 4: Lack of Open Discussion

Participants reported challenges in discussing bowel cancer screening openly. Specifically, participants often chose not to talk about the test with their

friends and family and mainly attributed this to the nature of the test being too distasteful and unpleasant.

> *'The problem is you wouldn't bring it up in the middle of a dinner party, you know. It's not kind of, 'do you know what I did last Tuesday? Let me tell you all about it'. I find it awkward and embarrassing. It's not, I wouldn't say, or I might say 'I went down to the hospital and had a blood test today'. That probably has more chance of entering a conversation than I did this test. So in the strata of pleasant to unpleasant it's fairly at the bottom in every respect.'*
> (P7, White British, male, non-screener, high SES).

Female participants, from a White British ethnic background, from varying SES levels, were more likely to initiate a discussion and champion participation in screening during discussions with others, however, participants experienced that whenever they approached other people in an effort to talk about the kit and share experiences, people were often unwilling and negative towards discussing about it. It was stated by some participants that other people often felt comfortable discussing breast cancer screening for example, but not about bowel cancer or the screening kit.

> *'I've actually spoken to a colleague today regarding this (i.e., kit) and she said 'oh, I haven't done mine yet, it's still there, it's still waiting to be done' and she kind of started blushing about it and mixing her words and we kind of dropped it. It's unusual really, because we talk about mammograms and that sort of thing but with this it's different and it bothers me.'*
> (P1, White British, female, screener, low SES)

Participants that had a family history of bowel cancer described feeling as having an obligation to talk about screening with family members, but nonetheless felt uneasy having a conversation about it.

> *'We have talked about it (i.e., with siblings), we kind of felt like we had to because of our family history, but it's just aghhhh (makes grunting sound), you know,. We all think of it as an unpleasant nuisance, a hassle but it's worth it, that sort of thing. Other friends do it as well. We don't talk about it, they have just said that they do it'.*
> (P3, White British, female, screener, high SES).

Several participants mentioned that they had conversations with others who had painted a negative image of the screening process, however, whether negative opinions of others acted to reinforce or inhibit personal screening participation was largely unclear. It might be useful for non-screeners to discuss about the test with people who, despite their own negative perceptions of the test, decided to take part

in screening anyway. Open discussion might in fact motivate non-screeners to reappraise CRC screening as a normal activity instead of disregarding it completely.

> *'Maybe a couple of years ago I got an invitation. I have heard people moan about it, that said that it's best to have it done but they didn't say if they had done it or not. But hearing about it from you, I swear I'll do it now (laughs). I probably needed to hear it from someone.'*
> (P18, White British, female, non-screener, low SES)

Participants also emphasised that the negative discourse surrounding the kit might deter people who are characterised by a natural tendency to feel disgust more acutely (i.e., have higher trait disgust) and therefore conversations should become more positive in order to improve public perception of the screening process.

> *'I had a friend, it was his first time doing it and he didn't like doing it at all, but he did it and he said he was a bit disgusting for him, you know. I didn't ask him too many personal questions. He says he didn't like doing it but he actually did it so it goes to show.. But we need to make the whole discussion around it more positive I think, it is a thin balance, some people who are squeamish might listen to someone else you know, saying this and that about the thingy, and how horrible it is and you know, you don't want to scare people away! (laughs)'*
> (P1, White British, female, screener, low SES).

Among racial and ethnic minority populations, an additional factor that seemed to prevent discussions on screening was low literacy in English, which in turn affected health literacy due to the difficulty in understanding medical concepts and terminology. Participants spoke about low health literacy preventing patient comprehension of the key preventive messages that appear in NHS screening materials, including the invite letter, information booklet and screening instructions.

> *Uh, they (i.e., other men at the community centre) may be shy. Some of them don't even know about it, or that they should be doing it. How are people expected to do it, when they don't know what it is or why they should be doing it? You know what I mean? I think many people simply don't know how to do it. Instructions in our language might help, although many of our people don't know how to read even in our language (laughs)'*
> (P23, Pakistani, male, screener, high SES)

This appears to be an important factor contributing to the non-uptake of screening among ethnic minority groups as being able to make an informed decision about screening largely relies on the ability to comprehend health-related information and/or discuss pros and cons with friends and family. Indeed the ability

to interact with others on health-related issues is considered a key aspect of health literacy (Smith & Nutbeam, 2013).

3.4.1.2. Theme 2: Awareness, Attitudes and Beliefs

The findings indicated that nonparticipation in gFOBT screening was partly explained by lack of awareness about bowel cancer and the benefits of screening. Most non-screeners reported not knowing that bowel cancer is asymptomatic and this led some participants to falsely believe that screening is not necessary. People from BAME populations were more likely to report that decision-making regarding their health was influenced by their religious beliefs and often expressed feeling reassured because they felt God would protect them from harm. Negative views towards the health system and medical mistrust were also factors that deterred some participants from screening.

3.4.1.2.1. Sub-theme 1: Lack of Awareness

The data indicated that one possible cause of non-participation in screening was lack of awareness about the asymptomatic nature of bowel cancer, the progression of the disease and the important role of screening as a secondary prevention strategy in cancer control. Lower awareness was more prevalent among participants from ethnic minority populations and socioeconomically deprived areas. People often saw a status of good health as being a reason in itself for nonparticipation in screening:

> *'Whether I've got it or I haven't got it, those types of thoughts would go crazy in my head. But I feel fine you know, I have no pain or discomfort down there so everything should be fine I think for me, I'm not too worried.'*
> (P18, White British, female, non-screener, low SES)

> *'I don't know much about bowel cancer, to be honest. I think it's about having blood in the stool, but I've never had anything like that so I'm alright, thank God!'*
> (P13, Pakistani, female, non-screener, high SES)

Among non-screeners it appeared that not being well informed about the link between cancer screening and early diagnosis, as well as improved disease prognosis, was a major determinant of non-uptake of screening. Reduced awareness about these links led some participants to trivialise screening and – in the absence of any cancer symptomatology - they did not appraise it as being necessary. In the following quote a man that had never done the gFOBT said:

‘I think that as long as you are healthy it’s fine. I don’t worry as long as I am alright and feel good. It’s only once you got so many medical problems that you would rather be dead than have to suffer. But you can have all the tests in the world and still get sick, so one could think ‘what’s the point’, you know?'
(P17, German, male, non-screener, low SES)

The above examples illustrate that associating the lack of symptoms with being ‘cancer-free’ might be an important barrier to screening participation. Additionally, it appears that not forming a direct link between screening and early diagnosis of cancer, as well as reduced awareness about the benefits of detecting cancer early, are both factors that can negatively impact on people’s decisions to participate in screening.

Another factor that seemed to influence participants’ understanding of the screening process was low health literacy. While many participants across all ethnic groups felt confident in understanding screening-related information (i.e., screening instructions, NHS Bowel Cancer Screening information booklet) and were well informed about bowel cancer screening, several participants from BAME populations did not recognise terms such as ‘bowel cancer screening’ or ‘screening kit’ and in these instances participants were shown the gFOBT demo, which acted as a prompt to facilitate further discussion. Low health literacy led to additional misunderstandings regarding the screening procedure and seemed to increase the risk of misinterpreting more complex screening-related terminology included in the NHSBCSP materials, such as ‘early detection’, polyps’ or ‘cancerous cells’. The extracts below illustrate that the difficulty to process and assimilate health-related information was an added obstacle among low literacy populations.

'I wasn’t sure I could read instructions. And I can’t remember seeing the invitation. I’m a bit confused as to why exactly I received it. I know what it is but I don’t remember how I know what it is. I can’t remember clearly sorry. I know that it’s something to check your health with.'
(P26, Pakistani, male, non-screener, low SES)

One man, who was a community representative at an inner-city South East Asian community group, indicated that poor health literacy is a key factor that prevents people from BAME backgrounds from making informed decisions about screening. Moreover, he highlighted the importance of social support among low-literacy populations and being able to rely on peers and family to access and understand medical information:

'I think some of the guys here (i.e., community men's club) will find it harder, to actually do the test you know, follow the procedures, I think some people at least from our community people that I know, are illiterate, and so I don't think they would be able to understand everything that needs to be done. So if they live alone and don't have friends or relatives to help them it is likely they won't even understand that they are being invited to screening.'
(P21, Indian, male, screener, high SES)

The inability to seek, process and comprehend health-related information seemed to be a critical barrier among non-English speaking participants from BAME backgrounds and was associated with nonparticipation in gFOBT screening.

3.4.1.2.2. Sub-theme 2: Healthcare System Distrust

Other patient-related factors, that appeared to be associated with non-uptake of bowel cancer screening, were negative beliefs about the healthcare system as well as generalised medical distrust. Although only a small proportion of study participants discussed this factor as being a barrier to screening, for those that did, it appeared to have a distinctive effect on their decision to engage with screening. Non-screeners were more likely to experience doubts with regards to whether the healthcare system is acting in their best interest as patients and expressed concerns with issues regarding data protection and confidentiality. The association between negative attitudes towards the healthcare system and screening behaviour is illustrated in the following excerpt:

'No, I don't think I would (i.e., do the screening), because I don't think I am putting anyone at risk in my activities, for example it's not like HIV that you can spread, so I would rather not know to be honest. But it's not just that, I do not trust the data protection. I have opted out from my GP making my medical information available. […] My views towards screening are not totally positive. My views towards medical politics is not.. I don't necessarily trust the system.'
(P12, White British, female, non-screener, high SES)

Stronger negative appraisals about the healthcare system and the intentions of healthcare providers seemed to correlate with past negative experiences with healthcare services and unpleasant encounters with healthcare providers. Medical distrust was also associated with concerns and beliefs regarding the gradual privatisation of healthcare services and worries about the government being controlled by vested interests which were thought to potentially have negatively impact on the quality of care patients receive and indicate that patients' best interests are no longer prioritised in light of financial rewards and/or incentives.

'There are politics, there is money involved, whose benefit is it? Is it for my benefit? And now there's all these, um, well I don't know. In my mother's day it was hysterectomies. About half the women had hysterectomies, which were unnecessary, right? Nowadays you have these breast mastectomies, and it seems to me that there is a sort of trend that men like carving up women's bodies that isn't necessary. So… I'm skeptical about medical politics, trends, data security, practices, fashions if you like.'
(P12, White British, female, non-screener, high SES)

Some participants expressed concerns about the NHSBCSP's decision regarding the cut-off age that people are invited to take part in the screening programme (i.e., 60-74 years). Beyond the age of 74, Public Health England (PHE) recommends that individuals ask for screening by requesting a kit themselves 'every two years for as long as they wish' (Public Health England, 2015). Some participants expressed feeling as if they were being 'written off' from services as they approached older age and found this worrying, given that the risk for bowel cancer increases with age. The fact that people are not invited to screen past the age of 74 was upsetting for some and this view was shared by both men and women, irrespective of SES, ethnic background and screening history.

'So over 74 (i.e., years) one has to ask for it? So even less people would do it? So basically they are written off (laughs)? That's strange, why would they write older people off? Perhaps they don't care about you anymore by that age'
(P17, German, male, non-screener, low SES).

'No, you have got to be proactive to do that (i.e., continue to request kits after 74) and a bit obsessive as well, haven't you, about your health? But then, why would they stop it at 74 (i.e., years)? I mean the risk goes up with age, the NHS should, um, I think it should really keep sending the screening invites past that age. I find it a bit upsetting that they stop then – what is it - are you too old so they just right you off?'
(P5, White British, female, screener, high SES)

3.4.1.3. Theme 3: Inconvenient Screening Procedure

Participants from all ethnic and socioeconomic backgrounds reported experiencing challenges with gFOBT screening procedures. Views of the test were particularly negative among men, irrespective of whether they were up-to-date with screening at the time of the interview. That is, both male screeners and male non-screeners expressed a strong dislike for the nature of the test and described the process as extremely inconvenient. All groups expressed that the dislike for the test stemmed

largely from the procedural difficulties related to the screening process, including the manual handling and sampling of one's own stool, storing the kit in one's home and posting the kit to the laboratory for examination.

3.4.1.3.1. Sub-theme 1: Procedural Planning

The multiple steps involved in the screening process were recognised by respondents as an obstacle towards participation. Participants felt that the collection of three stool samples required a certain degree of planning; for instance, the time frame in which all three samples should be collected, the time of day in which to collect samples in order to ensure they had privacy at home, finding a means with which to catch the stool, having time to 'clean up' afterwards and finding a location within their home, where the kit could be safely stored but not forgotten until all samples were collected, were some of the factors interviewees mentioned. The many stages required to ensure successful completion of screening sometimes left participants feeling confused, which in turn had an impact on their confidence and perceived self-efficacy.

> *'I had to plan it a little bit, there are a number of steps involved, and you know, you don't want to be doing it wrong and having to do it all over again […]. The most unpleasant part was dealing with the feces and trying to be sure that I was handling it, um, with suitable protection, and I feel the only way to do this is to make sure you understand what you are doing and think ahead, I mean having gloves, having enough loo role, soap and water just to have everything nearby helps.'*
> (P2, White British, female, screener, high SES).

> *'A bit of planning is required definitely. You have to work out 'where do I catch the stool' and that is an important step to this test because it mustn't touch the water and that definitely requires some planning. Especially if you hate the idea of the test, you want to find the best way to least interact with it.'*
> (P19, Cypriot, male, screener, low SES)

Furthermore, participants highlighted that having good manual dexterity skills and also being physically agile were both important factors in ensuring that the screening process was carried out smoothly from start to finish. Some participants described that having difficulties with either of these could be a discouraging factor and may represent an important obstacle to screening participation for people experiencing these difficulties.

'I think the most difficult thing was actually capturing your stool without it ending up all over your hands and all over the toilet seat. I can have quite shaky hands sometimes so I thought the test was tricky. The little windows for the sample were too small I think and I had to think about that a little bit.'
(P5, White British, female, screener, high SES)

'Agility is an issue in my opinion! Yeah, yes. I'm much less agile than I was… I think for me this test would be difficult, I can't imagine how I would get my hands back there to hold a container and you know (laughs).'
(P12, White British, female, non-screener, high SES).

There was also some confusion regarding the sequence and time frame in which the samples needed to be collected. For instance, a number of participants thought that they were required to collect the samples on three consecutive days. This caused a certain degree of concern among participants with regards to whether they would be able to have a bowel movement on three days consecutively and if not whether the test would be considered 'invalid' and they would have to repeat the process. Despite the fact that the screening information leaflet clearly states that patients have a 10-day period to collect the sample, this was a common misperception even among participants who had taken part in screening multiple times (i.e., repeat screeners).

'You obviously have to think about how you're going to do it (i.e., the kit)– it needs to be done on three consecutive days and so you'll need it to be, sort of in a position to do it whenever, when you're at home., it needs some sort of organising and planning.'
(P1, White British, screener, high SES).

'And you have to know that you've got the three consecutive days that you can do it, don't you? So you wouldn't be going away for a weekend if you are going to do it (laughs).'
(P3, White British, screener, high SES)

3.4.1.3.2. Sub-theme 2: Lack of Privacy

Although the majority of participants felt that it was easy to carry out the test as part of their normal daily routine, lack of privacy was acknowledged as an obstacle by some participants, particularly those who shared the house with other people or relatives Particularly, interviewees mentioned worrying about having to keep the kit in the house and the potential embarrassment they would experience if

another person accidentally found it. Participants often resolved to keeping the kit in their bedroom but described this as being unpleasant and also often caused them to forget taking the kit to the bathroom the next time they had a bowel movement. The concern of not having enough privacy was experienced by screeners and non-screeners alike and was irrespective of participants' socioeconomic status.

> *'I don't know, I've got a lodger I wouldn't really want to leave that hanging around. So I might have to keep it in my room, but I wouldn't want to do that. It's kind of disgusting, it might smell. I mean it's not a very medical looking test is it?'*
> (P12, White British, female, non-screener, high SES)

One interviewee, who shared a bathroom with other people, recommended that having a strategy to conceal the contents of the kit - for example, through the use of a 'pouch' – might facilitate the screening process for other people facing similar concerns.

> *'I don't keep mine in the bathroom all the time because I share my bathroom with others, so I have to keep it in my wardrobe and I have to remember to take it with me when I go. But it can be tricky to remember and you can't have it lying around you know what I mean (laughs). Maybe if they sent a little pouch with it? Like, you know, something you can seal it with, obviously, not a see-through pouch!'*
> (P14, White British, female, screener, low SES)

3.4.1.3.3. Sub-theme 3: Practical Difficulties

Participants from all ethnic and socioeconomic backgrounds identified practical barriers associated with gFOBT screening. Interviewees' accounts demonstrated that sending the completed kit through the post for examination raised concerns about whether the screening process was hygienic enough. Some participants found the process of posting the kit off-putting and worried about their kits being opened by mistake, not reaching the laboratory or even being returned to them. Hygiene concerns were expressed by many participants, however, it was not emphasised or singled out as being a major factor of nonparticipation.

> *'Well, I was quite happy posting it but it did go through my mind that I hope people wash their hands properly because they put that envelope through the post! Because I was thinking of other people handling these envelopes, some people aren't as good at these things as others. And it could become slightly dangerous if people are not following basic hygiene routines and not washing their hands, touching envelopes with dirty hands, you know?'*
> (P15, White British, female, screener, high SES)

Additionally, all of the interviewees indicated a distaste for handling faeces to a lesser or greater extent. Issues that were commonly mentioned included having an efficient strategy in place to catch the stool without it touching the toilet bowl, storage of the kit, smearing the sample on the card, scheduling the collection of samples around other daily commitments (e.g., work), anxiety over 'spoiling the kit' and having to repeat the process as a result, and safe disposal of kit materials after completion of the process.

> *'I don't think the instructions did much to be honest. You are kind of left on your own devices, sort of thing. You have got to figure out a way of doing it yourself. They should really have a way for you to do it. I think they say something about using loo role and that does not work, not for us women! It's very unpleasant and I can't understand how they could suggest that sort of thing. I think for a man it might be easy because they pass urine separately don't they, whereas for us… Using loo role just don't work well for us.'*
> (P14, White British, female, screener, low SES)

> *'Also there's the logistics of getting the stool sample. And, so you know collecting the stool sample, it's really gross and you have to use something like a bloody newspaper, or something and that's all, you know…, fairly unpleasant and awkward anyway. And.. I'm busy so I haven't done anything about it.'*
> (P12, White British, female, non-screener, high SES)

Interviewees who had infrequent bowel movements experienced additional concerns about effectively managing the screening process. For instance, participants suffering from constipation were concerned about their ability to smear the stool sample on the designated area of the card.

> *'The biggest thing for me was, I can vary from being normal to slightly constipated. And at that time I was slightly constipated, not that bad not that big a problem – but what I didn't realise was that when you are like that you don't realise how hard it (i.e., stool) was until I had to use the stick. And I was actually taken aback – […] it said 'spread it thinly' and I thought 'I can't even spread it all never mind spreading it thinly' so yeah.'*
> (P15, White British, female, screener, high SES)

Some participants were also concerned about managing to have three motions within the 10-day period due to having infrequent bowel movements. Additionally, interviewees described that having hemorrhoids as a complication of their constipation added additional worries as they feared they might receive a positive gFOBT result. Moreover, participants indicated that the booklet sent by the

NHS does not provide adequate information for people with constipation and/or hemorrhoids and reported feeling apprehensive doing the test, due to the prospect of being asked to undergo a follow-up diagnostic colonoscopy due to a false positive kit result.

> *'I don't think there's enough information there. And I got worried reading this because for me if I had piles and there was some bleeding or you have been straining there could be a bit of blood and I would be worried that they might say it is abnormal and start sending you for this other test and to me that is something, um I would say this was one of my biggest worries when I read this leaflet and then when I did the test. I got confused and frustrated as I wasn't sure I understood what result meant what depending on my individual circumstances.'*
> (P15, White British, female, screener, high SES)

3.4.1.4. Theme 4: Ick Factor

Results indicated that the 'ick factor' – that is, the feeling of disgust prompted by engaging with medical procedures (Morgan, Harrison, Afifi, Long, & Stephenson, 2008; O'Carroll, Foster, McGeechan, Sandford, & Ferguson, 2011) - was identified as being a significant theme due to frequency of its occurrence in the dataset. The majority of participants felt that the screening process elicited feelings of disgust and this finding was common across all subgroups. For non-screeners, the decision of nonparticipation in screening was largely influenced by their expectation that completing the test kit would be a disgusting process, indicating that disgust is an emotional barrier that is strongly linked to avoidant behaviour in the context of bowel cancer screening. Moreover, the data suggested that disgust sensitivity in relation to the kit varied by gender, with disgust being a more prominent barrier among men.

> *'I think on a descending scale the top barrier is the process itself. Which is a big barrier and you can't get away from it, you can't get around it, you can't go over it, it's there. It bring out very negative feelings at least for me personally. It is a generational thing probably. And everything else is very minimal compared to that. […] I also think that you have got a sex thing here. I would suggest - with of course no empirical data to suggest it - I would think, women would be more comfortable with this than men.'*
> (P7, White British, male, non-screener, high SES).

Female interviewees also talked about their husbands not wanting to take part in screening due to the test involving the collection of a stool sample.

'My husband is not the type that's going to mess around with, um.. Dealing with his own excrement and all the rest of it. And that's the attitude he's got. His mother had bowel cancer before she died and he still won't do it.'
(P10, White British, female, screener, high SES)

'I certainly know with my husband that with a lot of these sort of things he will go 'ugh ugh' it is just his reaction and I find it funny. Even with blood and operations he is just like 'ugh gross'.'
(P15, White British, female, screener, high SES)

Similar to men, female interviewees also described the screening kit as being a disgust elicitor, however, at the same time women were more likely to mention that other aspects of womanhood - including childbirth and taking care of a newborn, menstruation, menopause and attending breast and cervical cancer screening across the lifespan - were all factors that contributed to women having more positive attitudes towards healthcare partly due to an increased familiarisation with accessing healthcare services. The data indicated that women may be less disgust-sensitive due to increased familiarity in engaging with healthcare services more regularly than men, who do not have equivalent regular 'check-up' opportunities across the lifespan. The unfamiliarity with accessing and navigating the healthcare system may in turn lead to men being more reluctant to engage with health services such as cancer screening as they age.

'I mean for women, when we have babies, we see all sorts of things, we have periods all our lives, we have to deal with our bodies from a lot younger. Men I think freak out when they have to do something like this in their 60s for the first time. For us it's piece of cake (laughs). We have to deal with nasty things all the time. We have babies you know? We clean the house and the things somebody just has to do it and it's usually us, yeah?'
(P9, Afro-Caribbean, female, non-screener, low SES)

'*When you have smears, mammograms and all the other messy things that us women have, like menstruation, these thing don't phase you as much'*
(P4, White British, female, screener, high SES)

Similar opinions were expressed by male interviewees as well:

'Women are more involved with their bodies because of their periods and so on. They are more dependent really on the monthly period. That is an

indication of many things. They also have other consistent screenings, they have breast screening and so on and are generally more used to that kind of thing, unlike us men.'
(P17, German, male, non-screener, low SES)

Some female interviewees suggested that the effect of aversion and disgust elicited during the sampling process could, to an extent, be minimised by being organised and preparing for the screening procedure. For instance, it was considered important to have all the required equipment readily available and making the process as sanitary as possible; for example, using disposable gloves during the process, hand-washing with antibacterial soap after the collection of stool samples and immediate disposal of any equipment used, were all suggested to make the process more manageable and mitigate the effect of disgust.

'The most unpleasant part was dealing with the feces and trying to be sure that I was handling it, um, with suitable protection, and I feel the only way to do this is to make sure you understand what you are doing and think ahead, I mean having gloves, having enough loo role, antibacterial soap and water just to have everything nearby helps.'
(P2, White British, female, screener, high SES)

'I use those little plastic gloves that are disposable – I couldn't do it without the gloves! I would find it revolting, so got to have the gloves.'
(P3, White British, female, screener, high SES)

3.4.1.5. Theme 5: Fear of Cancer

This superordinate theme illustrates how the emotional barrier of fear in the event of a positive test result might further complicate participants' decision to take part in bowel cancer screening. Despite interviews being conducted with a healthy participant sample, fears about the consequences of a cancer diagnosis were discussed by the majority of interviewees. Participants' narratives on cancer fear and fatalism appeared to originate from concerns relating to the whole of the cancer pathway. For instance, participants were fearful of getting sick and potentially having to be hospitalised, receiving painful treatment and/or life-changing surgery and living with long-term health complications even beyond successful treatment of cancer. Fears about the emotional, physical and practical implications of cancer and how these affected motivation to attend cancer screening differed between BAME and White British populations, as well as

between interviewees who had previously taken part in screening and interviewees who had not. The following sub-themes are used to describe the multiple pathways via which fear, and indeed the interaction between multiple cancer fears, may affect screening participation.

3.4.1.5.1. Sub-theme 1: Avoidance as a Temporary Salve

This sub-theme identified the tendency of some people to ignore the screening invites due to the perception that taking part would unnecessarily expose them to the possibility of a cancer diagnosis. Therefore nonparticipation in screening was misperceived by some participants as a means of 'dealing with' and avoiding future emotional, physical and practical consequences from finding cancer. Non-screeners were more likely to express fears that had to do with the practical implications of receiving a cancer diagnosis and being a cancer patient. In the excerpt below one participant discusses a hypothetical scenario of being diagnosed with bowel cancer, where her primary concern was having to undergo treatment, which in turn would require making a series of difficult decisions regarding work – for instance, having to choose between giving up work completely or carrying on working during treatment – indicating that worries about one's finances and work arrangements, especially for individuals who are self-employed, are factors that are likely to affect people's decisions with regards to screening uptake.

> *'I think people are afraid to know because of what might be the next step – what happens next. Another thing that did actually cross my mind is that if they found cancer and I had to have treatment, my work comes in the summer so I can't not work. You know, so there are sort of practical issues there. '*
> (P12, White British, female, non-screener, high SES).

It is worth noting that avoidance of cancer screening was often discussed by participants in the third person, potentially due to social desirability. For instance, some interviewees chose to talk about avoidance of screening in an indirect manner by referring to instances of people they knew that decided not to participate in cancer screening as a means of evading the possibility of finding cancer, rather than directly referring to their own experiences and emotions.

> *'Is it like 'what you don't see doesn't hurt you' kind of an attitude towards life and health? I have many friends that think that way, I mean I do it too and I hate that I do it, but sometimes it's just easier to not think about these things*

you know? Or if you know you are very healthy you don't worry as much. I think I would know if I had cancer to be honest.'
(P13, Pakistani, female, non-screener, high SES)

Non-screeners, and especially those with a negative family history of bowel cancer, were less likely to be afraid of cancer, perhaps due to a lower cancer risk perception, which in turn was associated with screening avoidance. A lack of cancer fear was also often linked to not having experienced any symptoms and feeling healthy in that given moment in time. Not having experienced any cancer-related symptomatology seemed to instill a feeling of reassurance among some interviewees and was accompanied by the false belief that screening was unnecessary in the absence of any symptoms. The data suggested that the relationship between fear and perceived risk has an important role to play and may affect motivation to take part in screening, by reinforcing avoidant behaviour due to the misperceived lack of urgency. Specifically, in the first example one participant describes that having a family history of bowel cancer acted as a cue to action to screening participation, whereas the second excerpt demonstrates how a participant, without familial cancer risk, did not experience cancer fear due to a lack of experiencing any symptoms.

'I also felt like I needed to follow it through because in the back of my mind I was thinking you know, yeah, it could be in the family… I don't know… the history we have with bowel cancer… the idea of it scared me'
(P1, White British, female, screener, low SES)

'Perhaps the main thing for me is that if I don't feel anything is wrong, if I don't see blood in my stool, why should I bother to go see the doctor? […] I am not like other people that count days and worry all the time about death, I don't get obsessed with it. I have other friends that are obsessed and talk to me about illness and dying all the time and I tell them 'stop it, stop it'. I live in the now. And that's what's important. You can't think about illness all the time.'
(P11, Iranian, male, non-screener high SES)

3.4.1.5.2. Sub-theme 2: The Dreaded Test Result

Interviewees who had had the experience of waiting and receiving gFOBT results indicated that it was an anxiety-provoking process. Waiting for results fueled strong fatalistic thoughts about cancer among past screeners, however, this was often described as being a short-term barrier that was easy to overcome given the long-terms benefits of regular screening. Importantly, anxiety regarding the

potential outcomes of screening had a tendency to promote participation among White British, female interviewees from all SES backgrounds, but not among men and BAME populations.

> *'I think fear could intimidate people, that something might be found. Sometimes, I think, I'd rather not know, but I still go do it (i.e., screening). And I have known people say that about other tests so I really.. you can just shut it out and say 'I just don't want to know'. It is a bit like going to a fortune teller (laughs). Some people might want to go and others say I'd rather not know what my future is.'*
> (P5, White British, female, screener, high SES)

BAME populations and past non-screeners were more likely to directly associate cancer with dying and often referred to friends and loved ones who had passed away from cancer but seldom acknowledged the long-term benefits of screening or discussed positive stories from cancer survivors. In the excerpts below it is highlighted that strongly fatalistic beliefs – that is, the belief that death is inevitable following a diagnosis of cancer - are likely to be a strong predictor of nonparticipation in screening, mainly due to the lower perceived value of early detection tests. In this first example, the respondent discusses the idea of the inevitability of death following a cancer diagnosis.

> *'I'm not a person inclined to worry too much especially about health. Whatever will be, will be and there's not much you can do to stop these things, especially cancer. Once you have it, you have it and it is good to come to terms with these things. I suppose it is a bit of fatalism.'*
> (P17, German, male, non-screener, low SES)

In the second example, the participant's religious faith seemed to have an effect on their perceptions about their health as well as the value of screening. Specifically, the respondent described a perception of health that goes beyond one's control and also spoke of the notion that 'everything is predetermined' and reliant on 'God's will', implying a more fatalistic view of life.

> *'Well it's personal, people think about these things differently. For me I think it's my problem, it's my health, it's my life, I will decide when and if to check for these things. Nobody else can do that for me, not you, not my doctor, not anybody you know? Nobody knows about these things, nobody can see what is happening inside me, it is God who knows, and only He will know when it's my time. But I think this is important and it is my decision and how I think of my health that will help me do it, you know.'*
> (P22, Pakistani, male, non-screener, low SES)

Some participants also described experiencing increased anxiety over the possibility of finding out they had cancer through the means of a letter and ultimately being left with serious information concerning their health that they did not know how to interpret. One participant particularly, described that being notified of a bowel cancer diagnosis through a standardised letter would be traumatising and difficult to cope with, which indicates that direct access to test results may have important drawbacks. In the excerpt below the participant described the agonising experience of waiting for the kit results, which was further exacerbated by the thought of not having a medical professional offering the context and the opportunity to discuss the diagnosis and treatment options. It is worth noting that the majority of participants automatically interpreted a positive test result as having cancer and only few participants seemed to understand the difference between screening and diagnostic procedures for bowel cancer.

> *'If that test result had come back positive - it was obviously negative that I didn't have bowel cancer - but if it had come back anything other than that, if it came back saying there was something wrong, then I don't know how I'd feel to be informed in a letter, you know? Because when you have the personal touch with your doctor, or whoever, consultant? Then they can possibly reassure you? But if it's through a letter, then it's whoa!'*
> (P1, White British, female, screener, low SES).

3.4.1.5.3. Sub-theme 3: Treatment Fears

This sub-theme describes participants' fears about receiving cancer treatment and its long-lasting physical and emotional consequences. Interviewees particularly discussed the fear of having to undergo surgical treatment, and having a section of their bowel removed (i.e., colectomy). Participants described feeling fearful of having to wear a colostomy or ileostomy bag if they were diagnosed with cancer. Treatment for bowel cancer was often described by interviewees as 'horrible' and 'scary'; particularly negatively-charged words were used by participants to describe operative treatments for bowel cancer, with surgery being described as 'chopping' and 'cutting off' body parts. Fear of surgery was more frequently expressed by participants that had consistently adhered to screening recommendations in the past, perhaps due to greater awareness of cancer and increased involvement in cancer information seeking. Nevertheless, non-screeners also expressed a fear of surgical treatment for bowel cancer, without however this

factor being identified as a main driving factor for non-participation. It was more common for participants from White Ethnic backgrounds to discuss fears associated with cancer treatment and only few people from BAME backgrounds demonstrated awareness of bowel cancer treatment procedures. The following examples demonstrate the fear experienced by some participants with regards to the physical implications of surgical treatment.

> *'One of my neighbors has had it (i.e., bowel cancer), thank god she was okay in the end. Well, I say okay, I mean she is alive and I don't know the details but she ended up having a bag on the outside, which must be such a horrible thing to have to endure. I think she got rid of that now, and I see her out and about and I think she is doing well. But I don't know the idea of having to carry around a bag, I find that scary, I think it must have a detrimental impact on quality of life.'*
> (P15, White British, female, screener, high SES)

> *'Well would you like a bag stuck to you? And it's permanent as well. Just horrendous, I wouldn't be able to cope with that.'*
> (P12, White British, female, non-screener, high SES)

Some participants also expressed feeling fearful towards the possibility of having to undergo a follow-up colonoscopy if they received a positive kit result.

> *'I don't get embarrassed but the thought of getting a bad result back, and then if then there's something do you have to get a tube up your bottom or something (i.e., refers to colonoscopy)? If that could be avoidable then it would be better.. I wouldn't want to have to go through that.'*
> (P12, White British, female, non-screener, high SES)

3.4.1.6. Theme 6: Gender and Sociocultural Influences

This superordinate theme illustrates that gender and other sociocultural factors, including health literacy, religiosity and culture-specific norms and health beliefs are key determinants of bowel cancer screening behaviour. The data suggested that men from all ethnic backgrounds were more likely to trivialise engagement with screening and exhibited higher perceived invulnerability compared to female participants. Additionally, a range of sociocultural factors were embedded within this theme. Among BAME participants the importance of culture-specific health norms, religious beliefs and the association between health literacy and screening behaviour were all factors that appeared to influence screening

decisions. The impact of these factors is illustrated in the following three sub-themes.

3.4.1.6.1. Sub-theme 1: A Gender Issue

Participants of both genders appeared to hold the normative belief that men are less likely than women to engage with preventive behaviours, including bowel cancer screening. The data suggested that there are gender differences regarding attitudes towards screening and seeking medical help in general and there were greater levels of embarrassment/anxiety/distress reported by men in relation to the screening process. The majority of participants discussed attitudinal barriers that were specific to men and these were often positioned within the context of the social construction surrounding masculinity, where men were often characterised as unwilling to ask for help or engage with screening, even after they had experienced symptoms.

> *'It depends. Women are always wiser aren't they? They would probably find it easier. Men, especially after a certain age, are not as, I don't know what the word is.. Sometimes I think men just don't bother as much as women do? I think we like to think 'oh it's nothing, I'll be fine' and brush it off just to avoid going to the GP. Especially with bowel stuff I think that's the case'*
> *(P16, Cypriot, male, screener, high SES)*

Participants' views were often aligned with and seemed to endorse popular masculinity stereotypes and ideologies that portray men as less willing to seek help and more likely to view symptoms as minor and insignificant leading them to adopt a 'wait-and-see' attitude or downplay the importance of medical procedures.

> *'Men don't care about things like this. They can't be bothered. […] For men it's easy to forget to do checkups, and be mindful of what they need to do. I think women are better at this kind of thing (laughs) and they often remind their husbands to do what they need to do also.'*
> *(P23, Pakistani, male, screener, high SES)*

Other recurring barriers specific to men were a lack of familiarity with routine check-ups, a tendency for non-disclosure of medical problems and not feeling connected to healthcare services as much as women are.

> *'I think men find these things (screening, medical procedures) harder than women. I don't know why. Women are more adapted to these sorts of things than men are. […] And men don't talk about stuff like that, women do, don't they? They are more open, men aren't.'*
> *(P18, White British, female, non-screener, low SES)*

3.4.1.6.2. Sub-theme 2: Language Barriers and Health Literacy

Language barriers and poor health literacy appeared to be major obstacles for obtaining screening among BAME populations for whom English was not their primary language. Participants from BAME backgrounds reported that the screening invitation and booklet were not sent to them in their primary language, often leaving them confused and unable to understand, appraise and act upon the screening-related information. Some participants indicated that although they felt confident in their ability to read most materials written in plain English, they found it slightly more challenging to understand and derive meaning from information when more complex medical terminology used in the NHS screening materials, which seemed to further complicate their understanding of the information presented to them, potentially impacting on their ability to decide whether to take part in screening or not. One participant expressed that it would be important to implement strategies that would make health materials more accessible to people from BAME backgrounds. The excerpt below also suggests that involving community leaders, making health materials more culturally relevant to BAME groups (e.g., culturally-tailored materials), and translating materials or using English language in a simpler form, might motivate BAME populations to engage with screening.

> *'The only way to overcome that is to explain it to them in their own language, and have instructions in Urdu or in whatever language they speak. And pass that onto them, and even if they are not literate in their own language… Maybe in English as well but very simply. Maybe a practical demonstration – that's doesn't involve taking your trousers down or anything like that (laughs) – it would be alright. I think it would be alright, they would accept that and it would help them. Something should be included on this piece of paper (i.e., screening invite) that will make them understand it is for them. Maybe involving the wider Pakistani community and getting somebody that we trust from our community that understands how we think and can talk to us you know. We are a large and tight-knitted community and we would support each other.'*
> *(P21, Pakistani, male, screener, high SES).*

3.4.1.6.3. Sub-theme 3: Sociocultural Environment

In some instances, the health beliefs and attitudes towards screening were influenced by participants' religious beliefs. The impact of religiosity of screening decisions was more prominent among ethnic minority participants, and particularly Asian participants of a Pakistani origin. Specifically, some beliefs relating to spirituality and faith appeared be associated with a reduction in the perceived benefits of screening. The perceived role of God as a causal agent seemed to be a primary influence on the decision-making process to take part in screening among ethnic minority populations indicating that spiritual beliefs might be affecting health outcomes independently. For some participants, religion provided a framework for interpreting and understanding health-related events with the core belief that God is responsible for illness and health. The excerpt below indicates that spiritual/religious beliefs may be inextricably linked to beliefs about health, disease and behaviour. Whether people with external health locus of control express this through religiosity is something that remains unclear. It may be that people justify their non-uptake by placing greater importance and feeling reassured that their faith is a protective factor in its own right.

> *'Sometimes these things (i.e., illness, cancer) are God's will and no matter what you do, things that are supposed to happen will happen and that's how I see life in general. That's how I coped with my wife's death, this thinking helped me. […] Because when people are destined to die they will die. And if they are destined to live, they will live. Some people will die from cancer, others from something else. It's all part of my life. So no I'm not scared of cancer or death. If it's destined then it is what it is and I can't interfere with that, you know? Only God knows. What is gone is gone!'*
>
> *(P27, Pakistani, male, non-screener, low SES)*

Data from an interview with a Black Caribbean participant highlighted another sociocultural variable that might influence health-related decisions and referred to the potential importance of *cultural literacy*, defined here as the ability to recognise and use collective beliefs, customs, world-view and social identity in order to interpret and act on health information (Zarcadoolas, Pleasant, Greer, 2005). Specifically, the participant described that the norms and the values of the culture she grew up in in the West Indies dictated that negative experiences and/or emotions are not to be expressed and that conversations concerning aspects of a person's private life, including health and illness, should be internalised and dealt

with by the person independently. The excerpt below demonstrates how cultural influences might independently influence health behaviours.

> *'The way we were brought up in the West Indies was 'be seen, not heard'. You can't express yourself. You will be shut down if you ask too many questions. So all my life I was brought up to be quiet and now I find it hard to talk openly about things or complain about things. And even if it's for my health, especially if I can't express myself easily – it's the communication I also find hard you see. I won't talk easily about things and I think we generally are more private. Even if I have a problem, or a pain. I don't want to make a fuss you see. And if I have something wrong with me it's okay, I will deal with chin-up, tough you know.'*
> *(P9, African Caribbean, female, non-screener, low SES)*

The data suggests that the participant's cultural values led to the belief that seeking help, even when feeling unwell, is perceived as a weakness. Such culture-specific conseptualisations of health might be one of the many pathways via which screening uptake is affected, suggesting that future interventions that aim to increase screening among BAME populations could benefit from considering the influence of culturally normative practices and beliefs.

3.4.2. Cluster 2 - Perceived Facilitators to gFOBT Screening Uptake

This cluster encapsulates participants' thoughts and views with regards to the factors that motivated them to take part in bowel cancer screening. Interviewees discussed the importance of having positive social influences and prioritising long-term health over temporary discomfort associated with completing the gFOBT kit. Previous participation in screening increased awareness about the symptomatology and progression of bowel cancer and was associated with more positive attitudes regarding the benefits of screening and preventive healthcare, which were both strong facilitators of screening adherence. Familial history of bowel cancer, being a healthcare professional by background and an appreciation towards the NHS were also factors that promoted screening participation. Overall, both male and female participants from all ethnic and socioeconomic backgrounds identified benefits in screening. However, White British women were more likely to mention more than one factor that led to their decision to participate in screening. Non-screeners also expressed some positive views about screening during the interviews and for some the interview itself acted as a prompt to participate in gFOBT screening in the future. The following five themes – each with multiple sub-

themes – appeared essential in understanding the factors that promote bowel cancer screening participation: ‘Social Influences’, ‘Helping Oneself’, ‘Increased Awareness, ‘Grateful for the NHS’ and ‘Positive Attitudes’. Similar to Cluster 1, there were aspects of participants’ understandings that overlapped across these themes.

3.4.2.1. Theme 1: Social Influences

Participants that were up-to-date with screening reported having a social network within which they felt comfortable to discuss their screening experiences. Participants particularly emphasised positive social interactions with important others who often encouraged them to complete the screening kit. Some participants also highlighted that having a conversation about the gFOBT kit with their GP was a driving factor that led to screening uptake. Among ethnic minority participants with low literacy, having family members and/or friends who shared their knowledge and experiences and advised them on screening issues played a significant role. Overall, seeking help and support from others appeared to be a key mechanism through which low-literacy populations accessed and engaged with screening.

3.4.2.1.1. Sub-theme 1: General Social Support

Several participants expressed the importance of social support – specifically, participants underlined the benefits of feeling it was acceptable to talk about screening openly and being prompted by others to complete the screening kit. One participant described having a conversation with a colleague and feeling comforted by the fact that her colleague took interest in whether she had completed the screening kit:

> *' At that time a young colleague of mine, whose father actually had been diagnosed. And we got talking about this, and I told him this, that I had actually got the kit. And he said ‘do it do it do it’ and every time he saw me he asked me ‘have you done it yet?’. He saw I wasn't keen and I think he thought I was not going to do it. But it was nice that you know someone nudged me into doing it, that sort of thing.'*
> (P2, White British, female, screener, high SES)

The data suggested that participants also felt motivated to engage with screening after having had a discussion about it with healthcare professionals. Among BAME participants especially, it seemed that receiving a direct recommendation from their GP was a crucial facilitator of screening uptake. The

excerpt below suggests that this participant would not have used his screening kit had it not been repeatedly recommended to him by his GP, indicating the patient-physician interaction might be an important driver of screening uptake, especially for ethnic minority populations.

> *'If anybody asks me now about it or tells me about it I show them how to do it now! And I always tell them that they definitely must send it back. It helped that I had talked about this with my doctor, because I am certain I would have thrown it away. And he changed my mind.'*
> (P20, Pakistani, male, screener, low SES)

Moreover, BAME participants with low literacy seemed to rely heavily on their children and/or grandchildren to assist them with screening-related health information. For example family members went through the information booklet with them and explained the screening procedure to them, indicating that the processes of shared decision making and co-learning were important facilitators of screening uptake. In the following excerpt, one participant indicated that younger family members, with greater levels of acculturation may act as advocates of screening and provide social and decisional support:

> *'My daughters help me with these things and they will pester me to do things about my health. I think our people can be helped by their daughters. By their family, you know, younger family members that know the language and explain to them what's going on.'*
> (P23, Pakistani, male, screener, high SES)

The reciprocity of social support within friend groups and being able to exchange personal health experiences and information were also factors highlighted by some interviewees as facilitators of screening uptake.

> *'The group of friends we were in where all kind of 'we'll do it, it's a sensible kind of thing to do'. We were all in it together and we will kind of talk about these issues and encourage each other from time to me, it's that sort of thing.'*
> (P8, White British, female, screener, high SES)

Some participants felt motivated to act as advocates of screening and indicated that sharing their knowledge and experiences was important and contributed to the wellbeing of important others.

> *'Some people bring it to me, friends you know, and they ask me about 'why do I need to do it?' and I tell them it is for cancer and that if they do it and something goes wrong they will be looked after, sent to hospital and*

everything will be okay. But I tell them that if they don't it they simply will not know. And many of my friends do it now let me tell you'.
(P20, Pakistani, male, screener, low SES)

3.4.2.1.2. Sub-theme 2: Spousal Support

Participants considered spousal support to be important; both men and women reported that their partners often played a vital role in their decision to participate in screening. Traditional gender roles did seem to have some influence however; female spouses/partners were more likely than male spouses/partners to act as advocates of screening, initiate discussion about the screening procedure and encourage their partners to use their screening kit. Wanting to stay healthy for their partner and the perception the screening as a means to maintain long-term health were also key features of participants' narrative.

'I think if you have someone close to you, nudging you about it that could be good. In fact, to be fair my husband when he got his he through it to one side and went 'ew' and I said 'No, you will get it done, and get it done now' and kept saying for some days 'Have you done it yet?' (laughs). So yeah, I did influence him and in a way I did it and will carry on doing it because it is really important for me to know he is healthy.'
(P8, White British, Female, Screener, High SES)

The excerpts bellow demonstrate that the element of interdependence, which naturally exists between partners, may influence screening behaviour:

'My wife was very disgusted, more so than me, and I told her 'look, it's just a process that they are using to find out what's going on, so whether you like it or not it doesn't matter'. It's like if you are diabetic and taking insulin it doesn't matter if you like it or not you have to take it because it is necessary. It is a medical procedure. That's how I explained it to her and she accepted it you know.'
(P21, Indian, Male, Screener, High SES)

'My husband and I encouraged each other to do it. We are roughly the same age. Um, it was possibly me that got the kit first but I can't remember – I think they must've come relatively close to each other. Um, but we kind of pushed each other into doing it. We kind of made sure that the other person had done it. I think he just wanted me to do it, he wanted us both to do it.'
(P6, White British, Female, Screener, Low SES)

3.4.2.1.3. Sub-theme 3: Staying Healthy for Loved Ones

Participants often reported feeling a sense of responsibility and wanting to stay healthy for important others. Female participants in particular stated that they

had a moral responsibility to engage in screening to maintain best possible health, which in turn would assist in securing their independence and refraining from becoming a burden on their family members. Female participants' narratives of not wanting to be 'a bother on anyone' highlighted the endorsement of traditionally feminine norms of altruism, selflessness and sensitivity to the needs of others.

> *'But as I have got older it's gotten more and more important. I want to keep everything healthy, so you do as much as possible to do that. Health is a priority, not for everyone, but for me it is and I want to keep myself healthy, you know thinking of my kids and grandkids especially, I would not want them to have to deal with me being ill, therefore I try to stay as healthy as possible.'*
> (P10, White British, female, screener, high SES)

Male interviewees also emphasised the importance of self-care, but spoke less about keeping healthy for others and more about the importance of maintaining control over their lifestyles in order to promote and retain their quality of life. In the following citation one man expressed that he would prefer having the gFOBT screening annually because it would contribute to stronger sense of control over his self-care:

> *'As I said, my suggestion that they do it every year is linked to my general attitude of wanting to monitor my health. I want to be able to restore my health if anything is wrong with me. I care very much about being able to do the things I enjoy doing and enjoy life in general. This screening, despite being unpleasant, gives me a sense of control. I always attend the tests I am told - screening, PSA, cholesterol. I just care too much about being healthy (laughs)'*
> (P19, Cypriot, Male, Screener, low SES)

Despite the distinctly gendered ways in which participants spoke about their perceived obligation to engage in screening, all past screeners were more likely than non-screeners to articulate feeling fulfilled by making conscious efforts to minimise their health risks and subscribe to healthy living ideals. Participants' self-care efforts were not limited to screening uptake alone, and extended to engaging with various health practices, including having a good diet, being physically active and attending annual check-ups.

3.4.2.2. Theme 2: Helping Oneself

Screeners from all ethnic backgrounds and SES groups mentioned that the main motivation for participating in cancer screening was keeping healthy. Participants who were up-to-date with screening formed a direct association

between screening uptake and longevity and perceived the temporary discomfort related to doing the test as a small price to have to pay for maintaining long-term health. Consistent participation in screening was predominantly facilitated by the understanding that early detection via screening would lead to greater possibility of successful treatment and thus extended life. The excerpts below demonstrate screeners' perception that screening can be lifesaving.

> *'If you know you can make the best decision for yourself, obviously I want to protect my health and if there is a problem to restore my health, if there is a sickness, if you don't know about it you can't do much at all. It can really be a matter of life and death.'*
> (P19, Cypriot, Male, Screener, low SES)

> *'Well, it's good you know. If, uh, maybe there is some sort of problem that you don't know about, it is important to find out about it at the right stage. Then you can take medication you know, and something can be done about it. If you don't know about it you could die very quickly'*
> (P23, Pakistani, Male, Screener, high SES)

Repetition of screening every two years was largely discussed in the context of participants wanting to ensure a continuity of monitoring any changes that could indicate the presence of bowel cancer. Specifically, participants' narrative regarding biennial screening indicated that they associated this with having 'peace of mind'. Past non-screeners and past screeners alike experienced a certain degree of anxiety whilst waiting for screening results, however, screeners were more likely to perceive repeat screening as a way of managing those fears:

> *'[…] But at least I know there is a sort of sense of security, that if there is a problem I will hear from them. When you do these tests there are instances where you think something might be wrong but they offer you some peace of mind after you've done them and everything is good. Doing it every two years put my mind at ease.'*
> (P3, White British, female, Screener, High SES)

Among screeners, screening was perceived as a way of 'staying ahead of the game' and taking control over an unpredictable disease course. Some participants found it challenging to cope with the prospect of reduced quality of life due to advanced-stage cancer and felt that by consistently returning the kits every two years they were taking action to prevent the disease from becoming untreatable. Unlike non-screeners, who were more likely to become avoidant and

fearful in the prospect of receiving results that indicated a cancer diagnosis, screeners were keen to know whether they had cancer or not:

> *'I still believe that if you get cancer you are unlucky you are looking at potential fatality but I would still want to know – at least then I might be able to do something about it, you know, get treatment for it.'*
> (P3, White British, female, screener, high SES)

As mentioned previously, fear of cancer treatment festered behavioural avoidance for non-screeners, whereas screeners formed fewer negative associations with regards to receiving treatment (e.g., pain, recovery times, invasive surgery) and placed greater emphasis on the benefits of receiving treatment for cancer at the earliest stage possible. Indeed, screeners perceived screening as an opportunity to not only be successfully treated, but also to increase their chances of receiving minimally invasive treatment, which would also have fewer negative implications on their psychophysical recovery. One participant particularly highlighted that early detection of cancer would reduce her chances of needing a stoma, which was perceived as something that would greatly reduce quality of life:

> *'This (i.e., kit) is nothing compared to other things people go through, and it's so important to have it done. Bowel cancer is a horrible illness, so yes, this test is worth doing and by doing it every two years you might avoid needing a bag, which is an awful thing. The earlier you know, the more you can do, the less you will suffer and that's the bottom line form me'*
> (P4, White British, female, screener, high SES)

Overall screeners showed greater awareness about the benefits of prevention and early detection and formed direct associations between screening uptake and the maintenance of good health.

3.4.2.3. Theme 3: Increased Awareness

Participants with the most knowledge of bowel cancer screening tended to be more inclined to screen compared to those who were less knowledgeable. Increased awareness was also associated with less fatalistic views about bowel cancer and more positive attitudes towards the screening kit, with both of these factors being associated with an increased motivation and intention to participate in screening. Greater awareness about bowel cancer was also associated with less anxiety and embarrassment with regards to the screening process. Knowing someone who had been affected by bowel cancer and past experience with bowel

cancer screening were both instrumental factors associated with increased awareness.

3.4.2.3.1. Sub-theme 1: Knowing Someone with Bowel Cancer

Participants who had a close friend and/or family member who had either been diagnosed with or had died of bowel cancer were more likely to be up-to-date with screening. Having a personal experience of friends and relatives diagnosed with bowel cancer appeared to be an important facilitator of screening uptake and participants mainly attributed this to the fact that they had experienced first-hand the detrimental impact bowel cancer can have on people's lives and did not want to endure the same suffering themselves.

> *'Somebody who I know who lives in B****** he has done it and in fact was found to have bowel cancer through the screening yes – which was certainly a wake-up call. He certainly ended up having surgery and some other treatment for it. It shook me a think seeing my neighbour being so ill. Nobody is immune to cancer and I had to remind myself of that, because you tend to think these things happen only to others. Well, they don't.'*
> (P5, White British, female, screener, high SES)

Additionally, participants who had a family history of bowel cancer were more likely to perceive themselves as being more susceptible to the disease, and described this as being the main underlying motivation for participating in screening.

> *'Well yes, all my life I have been careful, I know I am at increased risk and also I worked in healthcare so while I was at work, you know, I definitely was measured before we even did the stool tests just to check that I'm okay'*
> (P4, White British, female, screener, high SES)

Thus, it appears that increased perceived susceptibility and greater awareness about the seriousness of bowel cancer might be factors that mediate the relationship between familial history and/or knowing someone with bowel cancer and subsequent screening participation.

3.4.2.3.2. Sub-theme 2: Being a Repeat Screener

Having participated in gFOBT screening at least once before motivated participants' decision to repeat the screening subsequently. This appeared to be related to participants' perceptions of self-efficacy related to the screening process. Specifically, participants described feeling less fearful and felt more confident in their ability to execute all the steps required for completing the kit. Irrespective of SES, participants expressed that completing the first ever kit was the most

challenging screening experience, partly due to misunderstandings relating to how the kit should be used and not knowing what to expect from the process, but that after having completed the kit once, they felt more positive about subsequent screening rounds:

> *'I think particularly after the first experience, which was difficult, it becomes very normal. I didn't have the same reaction after the second time. It is just that initial one which is new and different. […] You know what to expect, what you are doing and how it should be done. It gives you greater confidence I think.'*
> (P8, White British, female, screener, high SES)

> *'I read them (i.e., instructions) just the first time and the I kind of remembered what I had to do. It's the first time that I found the hardest because the whole process kind of surprises you. After that it was okay.'*
> (P14, White British, female, screener, low SES)

Some interviewees indicated that completing the kit for the first time was also associated with greater levels of stress, particularly whilst waiting for screening results, but also described feeling that the value of screening became more pronounced with repeat participation.

> *'When you do these tests there are instances where you think something might be wrong but they offer you some peace of mind after you've done them for a while and everything is good. Doing it every two years put my mind at ease.'*
> (P3, White British, female, screener, high SES)

In this example, one participant described that repeated screening also contributed to feeling less embarrassed about the stool-sampling process due to increased familiarity:

> *'I think I found the test was easier with every time that I did it, because I had sort of worked out a technique for capturing the stool. I think I also found it less embarrassing and awkward as well? And I became more comfortable with doing it because I knew the process which helped.'*
> (P5, White British, female, screener, high SES)

These findings therefore indicate that there may be a particular need to bolster self-efficacy beliefs, and particularly among first-time invitees, about completing the screening kit in future interventions.

3.4.2.4. Theme 4: Grateful for the NHS

Participants who were up-to-date with screening held more positive attitudes towards the NHS and spoke highly of the underlying structure and core principles

of the NHS – for instance, that it is free at the point of use, provision of high quality care, wide range of services available, high competency of NHS staff etc. Past screeners expressed greater appreciation for having the bowel screening service available to them especially in light of the funding pressures the NHS has been experiencing over the last decade.

> *'I definitely would want to request it (i.e., after the age of 74). I wouldn't even mind paying for it. I know the NHS is in a lot of trouble for money but it has the best health service provision and it's just so great that we have it.'*
> (P2, White British, female, screener, high SES)

At the same time, many of the participants frequently described feeling that they had a moral obligation towards the British taxpayer and they perceived non-uptake of screening as a misuse of NHS expenditure, thereby placing even greater economic burden on the health system by 'wasting' already scarce public health resources.

> *'I was really motivated to do this test. I think it's just the way I am. I was thinking 'I'm doing this test, it's for my benefit, people's resources, almost by respect for the people of doing it, and money it's costing – which I suppose is coming out of all our taxes – but ostensibly it's free – it's an opportunity.'*
> (P2, White British, female, screener, high SES)

Feelings of increased gratitude towards the NHS were more commonly expressed by participants whose parents had died from bowel cancer and felt that if there had been an equivalent screening programme available to their parents, they may not have died of bowel cancer.

> *'I did feel relieved because I didn't have and don't have any symptoms of what, say I can remember my father having. You just still don't know, do you? So I guess you're thinking as, as you're being tested, well you know, actually that's okay, my father never got that opportunity, he died 17 years ago when these tests weren't around.'*
> (P1, White British, female, screener, high SES)

Similar to non-screeners, past screeners also felt fearful towards the possibility of needing treatment for bowel cancer in the event of a bowel cancer diagnosis, however, at the same time they felt reassured that they would receive high quality care by the NHS and this belief somewhat alleviated participants' fears related to cancer treatment.

> *'The best part of this screening, and any screening you do as part of the NHS, if they do find anything that you will get treatment. Because we are very lucky here, we do get treatment, and we have amazing, super-hero NHS staff and we are well looked-after.'*

(P3, White British, female, screener, high SES)

Participants who held positive views towards the NHS were also more likely to report positive interactions with healthcare professionals. Particularly, participants seemed more likely to seek medical advice from their GPs when they perceived them as friendly, understanding, as taking a positive approach to their concerns and considerate in addressing sensitive healthcare issues. Good relationships with GPs fostered communication that participants felt increased the GPs' ability to provide appropriate medical advice that prioritised their wellbeing. One man, who was initially convinced he did not wish to complete the kit, decided to talk to his GP about it, who emphasised the importance of screening and managed to eventually convince him to participate in screening:

> *'I didn't throw it away but that's what I was thinking. But then I went to the doctor you know? And I took that card with me and the invitation and I talked to him about it. And he said 'no, you must send it to them'. I told him I wanted to throw it away, I don't want to do it and he said 'no you must do it and send it back to them'. So since then I have been sending them back! And I know that if I have similar issues in the future I can go to my GP and they will talk with me and we will work it out. I trust my GP with these things, his view you know and that he wants what's best for me.'*
> (P20, Pakistani, male, screener, low SES)

Therefore, it appears that GP involvement and patient-physician communication are factors that may act as cues to screening uptake.

3.4.2.5. Theme 5: Positive Attitudes

Positive attitudes toward living a healthy lifestyle appeared to be a key facilitator of gFOBT uptake. Participants who were up-to-date with screening were more likely to express motivation to manage their own health and wellbeing and tended to portray themselves as being proactive in monitoring their health. At the same time, participants' sense of responsibility about taking action to promote and/or maintain good healthy was particularly pronounced. Seeking health-related information was also a characteristic of participants up-to-date with screening, and particularly women. Overall, participants were more likely to express positive views toward and be up-to-date with gFOBT screening, if they a) demonstrated greater levels of health conscientiousness and b) reported having previous, positive experiences with cancer screening. The sub-themes 'Health Conscientiousness'

and ‘Past experiences with screening’ below, illustrate how positive attitudes may affect bowel cancer screening behaviour.

3.4.2.5.1. Sub-theme 1: Health Conscientiousness

Past screeners demonstrated greater levels of health conscientiousness. Specifically, they were more aware and concerned about wellness and appeared more motivated to take every step towards improving and/or maintaining their health and quality of life. Having a general *interest in health* appeared to be a primary motive for engaging in screening, as well as other health behaviours, and being self-conscious regarding health. Greater health conscientiousness seemed to be associated with a more positive perception of the screening kit and greater awareness about the benefits of screening uptake.

> *'I feel quite confident with my health and I am looking after myself very, very well umm.. I don’t feel that I have problem. But at least with this I know there is a sort of sense of security, that if there is a problem I will hear from them. I'm not just sitting back waiting for things to happen to me and then run around to fix it. It is all about prevention for me. […] I have also always been interested in my health. So no matter what, I think I would have still done it. I care about my health, I exercise, I eat right, everything really, that I can do I will do it.'*
> (P3, White British, female, screener, high SES)

Participants repeatedly described having a sense of moral obligation towards themselves to lead healthy lifestyles and they felt it was important to take an active rather than a passive role in the improvement and/or maintenance of their health.

> *‘It’s important for people to understand that there is noting more important than health and looking after yourself. If they don’t and just let it go, they may find they have something after 2-3 years when it is too late! And then they will regret not doing it earlier. So simply go do it for your own sake if not anything else. The test is not a big deal but the possibility of having cancer is.'*
> (P24, Pakistani, male, screener, high SES)

At the same time, past screeners were more likely to adopt a more pragmatic stance towards bowel cancer screening saying that it is ‘something that just needs to be done’ and there seemed to be less deliberation about whether they should be doing the screening or not.

> *'I think people just have to realise that this is part of normal life. Um, like going to the toilet is part of normal life. And the ‘ifs and buts’ people find as*

reasons not to do it is just not helpful, is it? I mean why don't people get it over and done with?'
(P2, White British, female, screener, high SES)

Greater health conscientiousness was also associated with the perception that staying healthy requires conscious effort and personal decision-making on the individual's behalf:

'Any screening I have been asked to attend I have always attended. These things are in place to help us and if people think about this in a serious way they will understand that all they have to do, what's required on their part is to just do the screening. That's all it is and that's how I look at it.'
(P6, White British, female, screener, low SES)

At the same time, participants maintained that good health was invariably the result of the extent to which individuals prioritised wellness and their ability to exercise self-discipline and subscribe to healthy living ideals. Comments such as 'you have to be proactive' and 'your health is up to you' were relatively commonplace among past screeners. For instance, one man emphasised that one could and should control their health to the extent possible:

'I think so, but I see that for the people that don't talk about it or do anything about it, it is often too late after you know. You can' control what happens to you health-wise but doing everything humanly possible to look after your health is really important. Whether that means taking your medication consistently, seeing your doctor, doing screenings, anything that helps keep you healthy really!'
(P24, Pakistani, male, high SES, screener)

Participants also articulated the sense that good health is something 'fragile' that needs to be protected and frequently monitored:

'If you care about your health and I mean really care you do everything you can to protect it. It's a matter of priorities every person has. And things can change very quickly and you can become ill very quickly so you need to be careful.'
(P19, Cypriot, male, screener, low SES)

Greater health conscientiousness was also linked to increased health information seeking behaviour. Participants who were motivated to lead healthy lifestyles were more likely to report greater intention and active efforts to obtain health-related information (e.g., health risks, illnesses, health-protective behaviours) above and beyond NHS materials. In particular, women were more likely to report seeking health information online:

'Haven't exactly worked in the health sector but I am interested in sort of, … I am just interested in the world, so I am interested in medical things. I have an interest in all things health and I like to take care of my health. I also quite like to read health articles in the papers, if there ever is one, and I do research online as well.'
(P6, White British, female, screener low SES)

'I am quite one for reading up for this sort of thing. If I see a health article I do like to read it. I'm not obsessed but I'm just generally interested in health and now with the internet, you know, it's easier. And I want to take good care of my health especially the older I get it's more and more of a priority?'
(P15, White British, female, screener, high SES)

It was also common for participants who were up-to-date with bowel cancer screening to demonstrate positive health behaviours in general. Specifically, screening participants were well-versed in what they should be doing to achieve overall good standards of healthy living and retain the best possibly quality of life as they get older/age. For instance, interviewees described the importance of having a healthy diet, being physically active and attending regular check-ups, etc.

'I changed my lifestyle because I had some bowel problems but I have also always been interested in my health. So no matter what, I think I would have still done it. I care about my health, I exercise, I eat right, everything really, that I can do I will do it.'
(P3, White British, female, screener, high SES)

3.4.2.5.2. Sub-theme 2: Past Experiences with Screening

The findings indicated that participants who had had previous experiences with screening that were positive, contributed to having more overall favourable attitudes towards bowel cancer screening and increased intention in participating in subsequent screening rounds. Positive past experiences were also associated with greater acceptance of the screening kit and stool-sampling process, with many participants describing it as 'convenient', 'easy to use', 'practical', 'painless' and 'non-invasive'.

'I think the way they do it is good, sending it to your house, you can do it in your own privacy, nobody bothers you, you feel comfortable at home you know. Its good the way they do it, it's quick and easy, doesn't hurt.'
(P21, Indian, male, screener, High SES)

Some of the female interviewees who had also been screened for breast and/or cervical cancer, were even more likely to highlight positive elements of the gFOBT screening process. For instance, women expressed that they much

preferred having to collect stool samples than having to undergo a mammogram or a Pap smear examination. Women described having rather negative previous experiences with mammograms in particular and perceived these as invasive, painful and embarrassing. It appeared that women may have had more favourable view of the gFOBT kit due to having experienced other, more invasive forms of screening.

> *'Well, to me it is totally non-invasive. It is not like the mammogram where you have everything being squashed and pushed up you, this is just doing what is natural and simply testing it so to me, out of all the three tests that women have regularly this is the least invasive'*
> (P15, White British, female, screener high SES)

Some women even perceived mammograms as being harmful and described experiencing pain for days after the mammogram procedure:

> *'If you ask me I think the breast screening is worse than this. It is more painful. I don't like the breast screening thing at all. They nearly took my breast off and I was in pain for days so you know. And I think that's worse, I don't even think that's natural, it might cause some harm I think to the tissues and so one. At least this is painless. And you get the results back fast as well, which is good.'*
> (P14, White British, female, screener, low SES)

Therefore, it appears that positive past experiences with bowel cancer screening, but also negative past experiences with more invasive forms of screening for women, may facilitate screening participation.

3.4.3. Cluster 3 – Attitudes towards the FIT versus the gFOBT

Given the imminent introduction of the FIT in England, the present research aimed to gather participants' preliminary views regarding the one-sample stool test and whether they thought the FIT would be preferable to the gFOBT. It is worth noting that findings from the present research to not provide a direct comparison between the FIT and the gFOBT, because at the time of the interviews being conducted, none of the study participants had a lived screening experience using the FIT. Rather participants were prompted to discuss their initial perception of being offered a one-sample stool test instead of a three-sample stool test. Overall, participants were more likely to indicate a preference for the FIT, however, a few participants were more inclined towards the gFOBT, mainly due to the misperception that the collection of more faecal samples increased the reliability of

test results. The findings are summarised in two themes ‘I prefer the FIT’ and ‘I prefer the gFOBT’, which are presented below.

3.4.2.1. Theme 1: I Prefer the FIT

The majority of interviewees expressed a preference for the FIT mainly because it was perceived as easier to complete due to requiring one stool sample on a single occasion. Preference for the FIT was evident across both screeners and non-screeners, however, men, participants with low SES and ethnic minority participants were more likely to indicate a preference for the FIT. One of the main reasons interviewees perceived the FIT as more convenient than the gFOBT, was that it does not require being stored in the house:

> *'Yeah, one sample would definitely be easier because then you’ve got the problem of that (i.e., gFOBT kit) hanging around. Where are you going to put it? Visitors come, ‘What’s this in your bathroom?’ I mean you know, where are you going to put it?'*
> (P11, Iranian, male, non-screener, high SES)

Another man also described that the general ‘unpleasantness’ of the test would be lessened, simply due to not having to repeat the stool-sampling process many times, thereby making the screening procedure more manageable:

> *'You see to have to deal with your feces is what makes this hard, the less you have to do that the easier the test will be. Having to do it multiple times and keeping it in your home is unpleasant, at least for me.'*
> (P20, Pakistani, male, screener, low SES)

Another participant, who had reported lack of time as one of the main barriers to screening uptake, expressed a preference for the FIT because of the process becoming more instantaneous and therefore less time-consuming:

> *'It’s not difficult and it’s a little bit more time-consuming than anything else. I think that could make it complicated for people like me. Because you have to do it on three different days and if you have for example to do one sample or even something like a blood test, then it’s a just a one-off […] it’s instant, whereas this (i.e., gFOBT kit) isn’t, do you see my point?’*
> (17, German, male, non-screener, low SES)

3.4.2.2. Theme 2: I Prefer the gFOBT

Some participants indicated a preference towards the gFOBT and this seemed to be predominantly influenced by the erroneous belief that the collection of more stool samples from three separate bowel movements increased the reliability of test results. This view was more commonly shared among individuals who had previously participated in gFOBT screening, but was not affected by

gender, ethnicity or level of SES. Moreover, this belief was more prominent among participants presenting with greater irregularity in their bowel movements:

> *'I think it is important to have to do it over three days because I think one sample is not enough. Especially for me, my bowels change a bit and if it is changing all the time one sample might not be enough to see if everything is alright, you know.'*
> (P14, White British, female, screener, low SES)

A number of participants expressed concerns about the association between the number of stool samples collected and the diagnostic accuracy of the test. Specifically, participants described being worried of a one-sample stool test being 'hit or miss' in its potential to detect cancer accurately:

> *'Actually, I quite like the three (i.e., samples). Because I thought it gives you an extra chance.. One thing I had questioned in my mind is whether the cancer will show up all the way through the stool or is it only in certain bits? In which case it could be missed couldn't it? So if you've got three separate days… I think the test becomes a bit more accurate. Whereas one, it's more hit and miss isn't it?'*
> (P2, White British, female, screener, high SES)

> *'Because you know, it is possible there is a mistake, so at least if you have given three samples you know that it's kind of safe that your result is correct. You can trust the outcome.'*
> (P23, Pakistani, male, screener, high SES)

The view that one-sample stool test may lead to a false positive test result was also discussed by one participant:

> *'No, three is definitely better. That's because one sample might have a problem, but the next could be alright. You wouldn't be able to know that if you only gave one sample. So by having three it's better, more reliable. Because one sample will not necessarily give you an accurate finding and you might be told you've got cancer.'*
> (P24, Pakistani, male, screener, high SES)

These preliminary findings suggest that preempting service users' expectations regarding concerns over the diagnostic accuracy of the FIT may be important in determining the acceptability of the test.

3.5. Discussion

Building on the work undertaken in Study 1, this study aimed to explore the barriers and facilitators in relation to gFOBT cancer screening uptake among different subgroups of the population. This study reports on qualitative interview data with an ethnically and socioeconomically diverse group of people from inner-

city areas of Leeds, adding to the literature on barriers and facilitators of bowel cancer screening uptake. The decision-making processes for bowel screening uptake were explored using Thematic Analysis, and revealed novel findings which have not yet been reported by previous qualitative research in this area. There is currently insufficient literature examining views towards the gFOBT kit by variation in SES, ethnicity/race, gender and screening history; rather the majority of previous studies have focused on exploring factors influencing uptake among particular subgroups; for example, among either White Caucasian or ethnic minority populations exclusively. Therefore the comparative nature of the present study extends previous research by involving multiple population subgroups, in an attempt to address in a more holistic manner the issue of inequalities in gFOBT uptake. The narrowness in past qualitative studies on the topic of bowel cancer screening uptake has made it challenging to decipher whether there are factors that are specific to populations with lower screening coverage (e.g., deprived, ethnic minority, men) and whether there are attitudes/beliefs that are common across different population subgroups. The present analysis identified that services users' reasoning for non-participation in screening was related to six themes, whereas the factors that promoted participation were summarised in five themes.

3.5.1. Summary of Principal Findings

Evidence from the study suggests that many beliefs were shared across population subgroups. For instance, emotional barriers, including the perception that bowel cancer screening is a taboo topic, feelings of embarrassment and/or disgust elicited during the faecal sampling process and experiencing anxiety whilst awaiting screening results, were all raised as broader issues that negatively affected screening participation among people from all socioeconomic backgrounds, as well as BAME and White British populations. Practical barriers, including the collection of samples and storing the kit, were more commonly reported by men, irrespective of SES, ethnic background and screening history.

Despite some commonalities across subgroups, a number of barriers were endorsed primarily by BAME populations. For instance greater cancer fatalism was observed among BAME populations, a finding which echoes results from previous research conducted in bowel (Lyratzopoulos, Liu, Abel, Wardle, &

Keating, 2015; Miles et al., 2011), breast (Facione, Miaskowski, Dodd, & Paul, 2002), cervical (Austin, Ahmad, McNally, & Stewart, 2002; Johnson, Mues, Mayne, & Kiblawi, 2008), lung (Bergamo et al., 2013) and prostate cancer screening (Odedina et al., 2011). Participants from BAME backgrounds were more skeptical about the value associated with early cancer detection and were more likely to perceive cancer as a condition that would unavoidably result in death. Moreover, ethnic minority participants, and particularly past non-screeners, expressed the view that cancer screening or efforts to treat cancer in the event of cancer diagnosis are futile and this often stemmed from perception that cancer is fated. Fatalistic beliefs appeared to be associated with participants' religious beliefs; for instance, individuals who adopted a God-centred framework of health, whereby disease prevention was perceived as being beyond human control and responsibility for health outcomes was deferred from oneself to God, were less likely to be up-to-date with screening. It has been reported elsewhere that religious values may affect preventive health behaviours in ways that acculturative or socioeconomic factors do not (Hayward, Krause, Ironson, & Pargament, 2016; Padela, Peek, Johnson-Agbakwu, Hosseinian, & Curlin, 2014), however it remains unclear whether religious beliefs and values deter or promote cancer screening, with some studies reporting negative (Padela et al., 2016) and others positive effects on uptake (Rajaram & Rashidi, 1999). Nevertheless, these findings indicate that fatalistic beliefs need to be addressed in future behaviour change interventions and/or public health campaigns, and that the consideration of particular belief structures and worldviews of BAME populations, when creating health promotion materials, may enhance screening uptake compared to more generic health messages.

It is a well-established finding that low awareness about bowel cancer and screening is not conducive to screening uptake (Goodman, Ogdie, Kanamori, Canar, & O Malley, 2006; Greiner, Born, Nollen, & Ahluwalia, 2005; McAlearney et al., 2008; Weller, 2005). Lack of knowledge is an independent predictor of negative attitudes towards screening and is associated with reduced intention to participate in future screening. Moreover, previous research shows that BAME and low SES populations report greater lack of awareness about bowel cancer (Javanparast et al., 2010; Liss & Baker, 2014). Evidence from the present research also suggested

that greater socioeconomic deprivation and ethnic minority status were associated with lower awareness regarding the benefits of screening and the risk factors of bowel cancer. Similarly, awareness levels were lower among past non-screeners, irrespective of level of SES and race/ethnicity, suggesting that screening participation does not rely solely on sociodemographic variables and is a behaviour that needs to be examined by simultaneously considering contextual factors affecting screening decisions. For instance, non-screening White British women, reported that the influences of traumatic past experiences with other forms of cancer screening (e.g., mammograms), unfavourable views towards the NHS and negative interactions with healthcare professionals, negatively impacted on their decision to participate in screening. Findings from the cancer screening literature also suggest that factors such as medical mistrust and negative healthcare experiences are factors that contribute to lower cancer screening attendance (Bynum et al., 2012).

Moreover, engagement with screening was heavily influenced by whether or not participants had familial cancer history; participants without familial cancer history were more likely to perceive themselves as less susceptible to bowel cancer and were more likely to misinterpret the lack of cancer symptomatology for confirmation of good health, which behaviouraly translated into nonparticipation in screening. On the other hand, participants that had a personal experience of cancer occurring within their families were more likely to be up-to-date with screening and were more likely to highlight aspects from their personal experience that related to the enduring physical and psychosocial consequences. Indeed, participants with familial cancer history were more likely to view the diseases as common and serious, suggesting greater levels of perceived severity. This finding in particular suggests that social influence factors can affect screening uptake and therefore require important consideration for intervention planning.

Health literacy also arose as a barrier among individuals with limited English-language proficiency and appeared to contribute to the, overall, lower rates of bowel cancer screening among BAME populations. Poor health literacy skills meant that participants relied more heavily on the provision of social support by their wider community and/or close networks in order to process and understand screening-related information. This is in line with findings from a recent systematic

review, which examined whether community-based initiatives can improve health literacy among older adults (de Wit et al., 2018) and showed that co-learning – a process whereby individuals interact and exchange health knowledge with family, community members and peers – was associated with substantial improvements in critical health literacy (defined here as “the understanding and ability to judge, sift and use information provided in the context of one’s own life”; Kickbusch, 2001; p.294). However, despite the benefits of social support, these sources of support were not available to all study participants – for instance, some study participants reported chronic health problems that prevented them from attending community group meetings, - thereby removing the option to interact and exchange information with others in order to make health decisions.

Health literacy has repeatedly been recognised as a critical factor that drives and sustains health inequalities in bowel cancer screening (Kobayashi et al., 2014; Oldach & Katz, 2014; Smith et al., 2016). The improvement of health literacy to promote health outcomes has been recognised as a major public health challenge (Harris et al., 2015) with current evidence suggesting that there are few effective interventions that manage to address health literacy issues and lead to substantial and sustainable behaviour change (Jacobs, Lou, Ownby, & Caballero, 2016; Nutbeam, 2000). Given that the current literature suggests that health literacy is not an easily modifiable construct, perhaps greater emphasis should be placed on alternative strategies to eliminate cancer screening disparities. For example, the present research highlighted the usefulness of implementing community-based initiatives and involving ‘trusted’ community leaders/representatives to advise community members about health issues. People from BAME backgrounds, who often lack other sources of social support, can gain much health knowledge through collaborative learning within their community, suggesting that it is important to increase our focus on strengthening social support and social networks in order to enhance uptake among BAME populations.

The present findings also suggest that greater GP involvement in the decision-making process might increase engagement with cancer screening for populations with lower levels of health literacy and acculturation; a finding also supported by previous research on patient-provider communication (Lafata et al., 2014; Nápoles, Gregorich, Santoyo-Olsson, O'brien, & Stewart, 2009; Nápoles et

al., 2015) service users might feel more willing to participate in screening if GPs were more engaged from the outset. Enhancing GP involvement might be particularly critical for improving uptake among BAME populations, given previous research showing that ethnic minorities in both the UK (Lyratzopoulos et al., 2012) and the USA (Saha, Arbelaez, & Cooper, 2003) report interpersonal quality of care overall more negatively than White Caucasian populations and experience poorer communication with physicians. Surprisingly, although the majority of study participants reported having positive views towards the NHS, medical mistrust was a barrier for screening for a small proportion of White British participants. Concerns about data protection, issues of confidentiality and/or suspicions about the provision of healthcare being influenced by financial motivations, were a few factors that contributed to negative perceptions of the NHS. However, such views also seemed to be influenced by past negative interactions with healthcare professionals as well as traumatic past experiences with other cancer screening programmes – for instance, some female non-screeners reported adverse experiences (e.g., pain, invasiveness) with breast and cervical cancer screening, which they seemed to transfer into the context of bowel cancer screening, despite the non-invasiveness of the gFOBT kit.

Similar to findings by previous research, social influence by close networks also played an important role in shaping bowel cancer screening behaviour (Adams, Richmond, Corbie-Smith, & Powell, 2017; Bynum et al., 2012). Important others represented a source of support, and often participants reported feeling motivated by their friends, family and even people within their wider community, to take part in screening. Across all population subgroups, particularly important was the influence of spousal/partner support, with findings from both quantitative (Manne, Kashy, Weinberg, Boscarino, & Bowen, 2012) and qualitative studies (Ekberg, Callender, Hamer, & Rogers, 2014; Manne, Etz, et al., 2012) suggesting that partners can influence screening decisions both directly - for example, by leading by example, by encouraging one’s spouse, and by using the relationship as a motivating influence – and indirectly – for example, by having a shared commitment and being supportive of each other to engage in practices that maintain and promote health.

One factor that stood out for motivating gFOBT uptake among past screeners, was the belief that one is morally responsible for one's own health choices. Interviewees, who were up-to-date with bowel cancer screening, tended to endorse proactive self-care and argued they had a moral responsibility to maintain good health and prevent cancer. Screeners strongly demonstrated a 'will to health', whereby cancer screening uptake was perceived as a behaviour that directly promoted self-care. Screening participants indicated that adhering to screening guidelines was driven, both by self-respect and the motivation to preserve personal wellbeing – a factor that was also associated with maintaining individual autonomy with older age - but also by respect towards their families and not wanting to become a burden on important others. The fact that the present research highlighted a strong sense of personal responsibility as a facilitator of bowel cancer screening uptake is particularly promising, given recent data published by the World Health Organisation (WHO) showing that lifestyle-related diseases, including cardiovascular diseases, cancer, chronic respiratory diseases and diabetes currently account for 77% of the total disease burden and 68% of total deaths globally (WHO, 2014). Indeed, the role of personal responsibility has growing pertinence in the literature (Ayo, 2012; Greener, Douglas, & van Teijlingen, 2010; Kähkönen et al., 2015; Lupton, 2012; Steinbrook, 2006) which proposes that screening promotional information may benefit from the inclusion of social-responsibility statements to motivate action to change.

Screeners were also more likely to emphasise the convenience, privacy and autonomy with which the gFOBT test can be completed. The fact that bowel cancer screening does not require scheduling and attending a medical appointment was particularly highlighted as a positive aspect of the screening kit and appeared to improve the sense of self-efficacy and perceived behavioural control over the screening process; both factors that have been positively associated with participating in cancer screening (Beydoun et al., 2008; Orbell, Hagger, Brown, & Tidy, 2006). Of note, perceived self-efficacy appeared to increase as a result of repeat participation in screening, with multiple screening participants expressing that the first episode of screening was the most challenging. This is important information for consideration in the design of interventions targeting first-time invitees (i.e., prevalent screening episode). It is also possible that including

statements that accentuate the convenience of home-based screening may lead to greater uptake, which in turn may promote repeat participation.

Perceptions of the FIT versus the gFOBT revealed somewhat unexpected findings; despite interviewees mostly agreeing that the FIT would be easier due to the convenience of having to collect one stool sample, a number of participants expressed concerns over the diagnostic reliability of a one-sample screening kit. Participants with irregular bowel movements in particular, were more likely to indicate a preference for the three-sample stool test in fear that one sample could lead to a misdiagnosis of cancer. This is somewhat unexpected, as one might expect that the requirement of one stool sample would automatically lead to more positive test perceptions. Nonetheless, this finding highlights the importance of emphasising the superiority of the FIT in terms of diagnostic accuracy during the initial phases of the introduction of the FIT in order to avoid any public misperceptions of the new kit.

3.5.2. Limitations

Despite using a maximum variation sampling approach during participant recruitment, it was evident that female participants in the present sample were predominantly from a White British ethnic background and tended to have a higher SES. Few women in the sample were from BAME backgrounds and there was a particular lack of women from Asian/British Asian backgrounds, which represents a large ethnic group in the UK. However, there was a strong representation of Asian/British Asian men within the sample, suggesting that the views of this particular ethnic group were adequately represented within the data. Nevertheless, given that the results highlighted important differences among men and women in relation to gFOBT screening participation it would have been useful to recruit more women from this ethnic group to further explore their views in relation to screening.

A further limitation was that screening uptake was assessed retrospectively, via self-report. It is therefore likely that participants may have misreported past screening behaviours, either due to difficulties in remembering past screening episodes accurately or due to social desirability bias, which is more pronounced in qualitative research, and particularly 1:1 interviews, due to the more intimate nature of research conversations, which are likely to intensify participants'

tendencies to want to make a positive impression on the researcher (Collins, Shattell, & Thomas, 2005).

3.5.3. Researcher Reflections

In this section, I, the primary researcher reflect on the processes and logistical challenges posed by conducting qualitative research (i.e., Study 2) with ethnic minority and low SES participants. The aim of this section is two-fold: firstly, to provide an overview of some of the main barriers I experienced with regards to gaining access to, recruiting and conducting interviews with participants from BAME and low SES populations, and secondly, to provide some practical guidance, recommendations and key learning points that other researchers may find useful when planning and/or conducting research with marginalised populations. My intention for this section is to provide a summary of post-research reflections, which may be informative to new qualitative researchers, like myself, as well as more experienced researchers with an interest in health inequalities research. This section does not however provide an exhaustive list of all the possible components important to conducting research with marginalised communities.

3.5.3.1. Key Learning Point 1: Collaboration with Community 'Leaders'

The involvement of BAME and low SES populations in my doctoral research was a complex and multi-layered challenge; the resources, energy and time required to firstly, identify eligible participants from the communities of interest and secondly, recruit participants were substantial. From the onset of the research it became apparent that enlisting the active assistance of community 'leaders' (also referred to as community gatekeepers or community stakeholders) was imperative for enhancing people's motivation to participate in the research. Previous research has emphasised the importance of collaborating with community 'leaders' in order to gain access to ethnic minority and low SES groups (Rugkåsa & Canvin, 2011; Shedlin, Decena, Mangadu, & Martinez, 2011; Sheikh et al., 2009). Community 'leaders' not only understand the networks and wider socio-cultural norms and beliefs of the communities of interest, but also have an inherent understanding of the population-specific barriers in accessing healthcare services (Fassinger & Morrow, 2013). I came to deeply recognise their value and support was central to the success of accessing and recruiting participants otherwise reluctant to engage

with research. However, it must be emphasised that developing and establishing relationships with important stakeholders and community representatives is a complex and time-consuming process. Firstly, as reported elsewhere, there are challenges in defining who does and does not hold the position of 'community leader' or 'community representative' and the extent to which these individuals have influence their communities (Sheikh et al., 2009); in this respect, it was helpful that my doctoral research was funded by Leeds City Council (LCC), which works in partnership with community representatives and could readily provide their contact details. Having LCC as a link between myself and community 'leaders' greatly increased the possibility of gaining access and having the personal contact details of community 'leaders' was a key deciding factor when deciding which organisations to approach during the pre-implementation phase of Study 2. It is worth highlighting that it took a lot of time and personal effort to get from the point of initial contact with an organisation and/or community 'leader' to the point of gaining access. For instance, I organised and attended meetings with healthcare professionals (HCPs) I knew through the wider LCC network, who had previously conducted research with community organisations in order to improve my understanding regarding the correct protocol of requesting access, I dedicated time to phone calls and email communication liaising with community 'leaders' and on numerous occasions I arranged pre-meetings with community 'leaders' in order to discuss the study in further detail before they decided whether they were willing to grant access or not. Initiating and maintaining good working relationships with community 'leaders' required very clear communication on my behalf regarding both the procedural aspects of the research (e.g., when, where and how the research would be implemented) as well as the broader context of the research (e.g., aims, wider implications). Most importantly the key question I had to be conscious of and clearly communicate to community 'leaders' was, how can this research be conducted with the minimum inconvenience and maximum benefit for the participating organisation and its members? Organisations involved in doing community work with low SES and BAME groups often receive an overwhelming number of requests to be involved in research; in some discussions I had with community 'leaders' they reported that their previous engagement in studies had been largely negative, which in turn led them to being uncertain, anxious and

skeptical to participate in research anew and to grant access to future researchers. Some of the negative past experiences stakeholders reported included: researchers not being punctual, not attending/cancelling scheduled interviews with participants, not being clear about the time commitments involved to participate in the research for both the organisation and participants, being vague about the purposes of the research and not displaying cultural competence and/or cultural sensitivity tailored to the community of interest. These discussions further engaged me in reflecting on the research process from the stakeholder's perspective and helped me gain a better understanding of the reservations they might have when agreeing to participate in research. A few key learning points from my research were: a) that planning and resources bust be invested in initiating and developing collaborations with community leaders from the outset; b) having a pre-existing link between the researcher and a community organisation and/or community 'leader' can facilitate the process of gaining access (in the case of my research the link was LCC); c) conducting all research activities in a way that minimises inconvenience for organisations and participants and making an organisation's participation in research a positive experience, as not doing so will have negative implications for future researchers aiming to gain access to these communities.

3.5.3.2. Key Learning Point 2: Translator/interpreter Services

Another reflection concerns the non-use of interpreters/translators in my research. It would have been beneficial to involve interpreters/translators as it is likely that more people from BAME communities might have been willing to take part but were unable to due to having no, little or insufficient knowledge of written or spoken English. Unfortunately, due to financial and time constraints it was not possible to involve interpreters/translators in Study 2, which meant that some individuals from the communities of interest did not stand an equal chance of having their views expressed on the topic of CRC screening uptake. Therefore, future research interested in understanding, responding to, or even investigating the challenges BAME populations face with regards to accessing health services would benefit from involving interpreters/translators in order to bridge the language barriers between researchers and participants. Through conversations with public health specialists and healthcare professionals involved in commissioning and /or providing local services for LCC, it became clear that accessing and utilising

interpreter/translator services poses its own challenges due to a shortage of professional interpreters/translators - which is particularly relevant to accessing certain communities (e.g., Kurdish) - and due to a lack of availability and long waiting times. Therefore, it is important that sufficient time is allowed for sourcing and engaging interpreters/translators and that such considerations are made throughout the research process (i.e., from the pre-implementation phase to the recruitment and implementation phases); for instance, an interpreter/translator will be involved in both conducting interviews and completing transcriptions, which represents a substantial time commitment. Other research has highlighted a range of potential methodological barriers which should be considered when involving translators/interpreters into the research process – for instance, challenges in assessing the interpreter's linguistic credentials, difficulties in differentiating languages from dialects, ensuring that the interpreter/translator is committed to accurately conveying what is being said (i.e., conceptual equivalence), verifying accuracy of transcription/translation from an independent source and assessing whether the translator's presence affects the narratives constructed by participants, and therefore the reliability of the research (Larkin, Dierckx De Casterlé, & Schotsmans, 2007; Squires, 2009; Sutrisno, Nguyen, & Tangen, 2014).

3.5.3.3.Key Learning Point 3: The importance of cultural reflexivity and interviewing style

Cultural reflexivity was also a crucial element in the study. As a researcher and as a person from a non-ethnic minority myself, from a younger age group, who has not been invited or competed a CRC screening kit, it was essential that I made a consistent effort to examine the subject of CRC screening uptake from the position of the participant and to not allow my own preconceived notions about participants to influence my interpretation of their experiences. Due to being a novice researcher myself with no prior experience of conducting interviews with BAME and low SES populations in the community, I initially found this challenging and was constantly conscious to not misrepresent the views of study participants due to communication difficulties that inevitably arise when researchers and research participants have disparate worldviews. Upon reflection, it was particularly helpful that the interviews followed a semi-structured format as this offered the opportunity to explore participants' realities and how they made sense of the

screening process without being confined to a strict interview guide that I needed to rigidly adhere to. Post-research reflections also concerned the importance of my interviewing style; it was particularly helpful to acknowledge in and for myself my inexperience in conducting interviews in community settings with marginalised populations and to remind myself to stay curious and open to participants' stories. Staying curious and open was key to learning to deal with the unexpected and gain a more in-depth understanding or each participant's social world irrespective of their cultural or socioeconomic background. I think the fact that I am a foreigner in the UK myself was helpful in not having deeply engrained, pre-conceived ideas regarding the NHS and the quality of and access to healthcare services in England; in a way my 'foreignness' helped me maintain a neutral stance to some strong views that were expressed by interviewees (e.g., negative experiences within the NHS, medical mistrust) and helped expand my understanding with regards to the multiple 'stories' of the same topic. Central to building rapport with participants from a variety of ethnic and socioeconomic backgrounds was being an active, interested and non-judgmental listener. I believe that these qualities (i.e., openness, staying curious) not only helped establish good rapport but also made the interview process more meaningful to participants; a few participants disclosed to me after the interview that they found our conversation empowering and that they felt they had contributed to something of value, which I think was largely due to participants feeling 'heard' during the interview process. The fact that interviews were conducted in participants' communities, where people felt comfortable and welcomed to, was important in facilitating recruitment and building trust and also eliminated barriers relating to transportation, time and location. I also feel that the fact that I was the 'outsider' in those communities, neutralised the power that, by definition, researchers have, and therefore helped prevent the development of any power imbalances between myself and interviewees. Overall, my experience with conducting Study 2 highlighted that the researcher's interviewing style is central to conducting meaningful qualitative interviews with people from all walks of life. There are lessons to be learned about the importance of approaching the interview from a position of curiosity and attending closely to participants' personal narratives rather than being focused on entertaining our own predilections.

3.5.3.4. Concluding Remarks and Key Messages

Currently, there is an invisibility of diversity in the majority of published research concerning access to and use of cancer screening services (and healthcare services more broadly) among minority ethnic communities and low SES populations in the UK. This has potential to contribute to the perpetuation of existing barriers and to the preservation of inaccessible health services, which in turn is damaging for the experience of and/or health outcomes for BAME and low SES communities. Unless current practices on how research is funded and conducted change and are adapted to the needs of these specific communities, it is unlikely that progress will be made in understanding the difference and complexity of how people from ethnically and socioeconomically diverse backgrounds experience healthcare services. Increasing the number of people from BAME and low SES communities in health research is therefore vital to improve academic knowledge and in turn inform policy and practice. Reflections in this section on the topic of recruiting and conducting interviews with BAME and low SES participants to explore the factors that influence CRC screening participation highlighted a number of issues that can influence the access to and experience of taking part in research. In summary, this section highlighted some key factors that should be considered by future research, which are:

a) Collaboration with community 'leaders'/gatekeepers/stakeholders should be prioritised as a means of approaching BAME and low SES populations

b) Researchers may benefit from having a wider professional network of HCPs and/or organisational support (e.g., local council) as both may act as valuable sources of support and expertise with regards to accessing and developing relationships with community 'leaders' and, more widely, the communities of interest.

c) Researchers should consider the possibility of involving translators/interpreters where possible whilst at the same time being aware of the complexities attached to this process.

d) Researchers should ensure that they are actively making an effort to develop a culturally reflective interviewing style and that they are demonstrating their respect for the communities being studied.

e) Researchers should be actively listening to participants' narratives and should maintain an 'open and curious listener' position, which may make participation more meaningful for the members of the community under investigation.

f) Researchers should be aware of the additional resources, time and effort required in accessing and recruiting participants from minority ethnic and socioeconomically disadvantaged communities in health research; greater awareness about the complexities in accessing and recruiting these populations may facilitate their recruitment in healthcare research in the future, which has important implications for improving access to services and health outcomes for everyone in society, regardless of their socioeconomic or ethnic background.

3.5.4. Conclusions

This study provided an opportunity to explore the views of a range of different population subgroups in relation to the barriers and facilitators that may affect people's decision making in relation to gFOBT screening uptake. Overall, the findings indicated that service users experience both practical and emotional barriers and expressed concerns relating to the entirety of the cancer pathway including the pre-diagnosis, diagnosis and post-diagnosis/treatment phases. Substantial differences were observed among men and women, with men reporting greater practical barriers in relation to stool-sampling procedures compared to women, as well as between BAME and White British populations, with participants from BAME backgrounds experiencing greater practical difficulties often due to lower levels of health literacy, which in turn negatively impacted on levels of knowledge and awareness in relation to gFOBT screening. Some differences were observed among past non-screeners and screeners, with past screeners being more likely to express feelings of gratitude towards the NHS and exhibiting greater health conscientiousness compared to non-screeners. Differences between participants with higher and lower SES were less pronounced. The next chapter of this thesis (Study 3) seeks further explanation for the variation in screening uptake between the population subgroups presented within this chapter. Specifically, the next study will explore the direct and indirect associations between sociodemographic factors, psychosocial variables and gFOBT screening intention.

CHAPTER 4

An Exploration of Sociodemographic and Psychosocial Factors as Predictors of gFOBT Screening Intention (Study 3)

4.1. Introduction

Study 2 examined the factors that either facilitated or inhibited bowel cancer screening uptake. Specifically, Study 2 provided a qualitative analysis of participants' perceived barriers and facilitators and explored how these affected gFOBT screening by variation in SES, ethnicity, gender and past screening history. Results revealed that some barriers, both emotional (e.g., embarrassment, disgust) as well as practical (e.g., stool sampling difficulties), were common across all population subgroups. At the same time, findings indicated that there were substantial differences between White British and BAME populations, men and women and past screeners and non-screeners. Some differences, such as level of awareness about screening and knowledge about bowel cancer risk factors, were highlighted between high and low SES populations, however, the effects of SES on gFOBT screening uptake were overall less clear. Study 2 enabled the preliminary exploration of psychosocial factors that might determine the different ways that service users understand bowel cancer screening, including the ways they perceive it and their attitudes towards it. However, due to the exploratory nature of qualitative research, it was not possible to pinpoint specific sociodemographic and psychosocial constructs that influence people's intention to participate in screening. The present study draws upon findings from the previous chapter and uses a quantitative methodology to test whether: a) sociodemographic and psychosocial factors directly influence gFOBT screening intention, b) psychosocial variables mediate the influence of sociodemographic variables on intention, and c) whether sociodemographic factors moderate relations between psychosocial variables and gFOBT screening intention.

A psychological approach, informed by social cognition models (SCMs), for the exploration of gFOBT screening behaviour was considered appropriate within the context of the present thesis for a number of reasons. Firstly, findings from the previous chapters identified and demonstrated the importance of number of

psychosocial factors that appeared to affect people's decision-making processes with regards to CRC screening, thereby prompting the need for additional exploration. Secondly, it has been proposed that cancer screening is a behaviour that involves a dual psychological process, whereby on the one hand individuals weigh the risk for consequences – that is, the upsetting possibility that screening could lead to the detection of a potentially deadly disease – whilst on the other hand they are considering the benefits of action – that is, that taking part in screening provides greater assurances that in the event cancer diagnosis does occur, detecting it at the earliest stage possible will lead to greater chances of survival and important long-term health benefits. Indeed, psychological theories of health behaviour propose that an individual's risk perception can motivate health behaviour (Janz & Becker, 1984; Rosenstock, 1974; Rothman et al., 1997; Weinstein, 1988). Theory-driven, health behaviour change interventions that have tested such theories have shown that targeting and changing risk perceptions (e.g., perceived severity, perceived susceptibility) has important consequences for health behaviour change (Brewer et al., 2007; Ferrer & Klein, 2015; Noar & Zimmerman, 2005; Orbell, Crombie, & Johnston, 1996; Orbell, Perugini, & Rakow, 2004). Thirdly, within the wider health behaviour change literature, SCMs have provided useful frameworks that have enabled and advanced our understanding with regards to the choices and actions that people make in relation to their health.

Psychosocial constructs proposed by SCMs, have consistently been found to be predictors of health behaviours and targeting such variables through health interventions has successfully elicited behaviour change (Conner & Norman, 2015). Meta-analyses have shown that SCMs such as the Theory of Planned Behaviour (TPB; Armitage & Conner, 2001; Godin & Kok, 1996) and its precedent, the Theory of Reasoned Action (TRA; Shepherd, Hartwick, & Warshaw, 1988) have good predictive ability both in terms of behavioural intention and actual behaviour for a range of health behaviours. The predictive ability of SCMs is particularly well-established in relation to physical activity (PA) and dietary behaviour with several studies showing that social cognitive constructs explain 40-71% of the variance in relation to PA behaviour among adults (Ayotte, Margrett, & Hicks-Patrick, 2010; Phillips & McAuley, 2013; Rovniak, Anderson, Winett, & Stephens, 2002; White, Wójcicki, & McAuley, 2011), and approximately 36-61% of the variance in fruit and

vegetable consumption (Anderson-Bill, Winett, & Wojcik, 2011; Anderson, Winett, & Wojcik, 2007).

Within the context of cancer screening behaviour, few meta-analytic reviews have examined the application of the integrated TRA/TPB in relation to cancer screening uptake. A meta-analysis on the application of the TPB to health behaviour by Godin and Kok (1996) reported that constructs of the model combined, explained a significant proportion of the variance in screening behaviour. Moreover, the authors reported strong, positive associations between TPB-based constructs - including subjective norms, attitudes and perceived behavioural control (PBC) - and intention and behaviour; findings similar to those reported for other health behaviours (Armitage & Conner, 2001). A more recent meta-analysis by Cooke and French (2008) , which included 33 studies, quantified the extent to which TRA/TPB predicted intentions to attend cancer screening programmes, as well as actual attendance behaviour. Similar to the findings by Godin and Kok (1996), the authors reported large-sized relationships between attitudes and intention (r = 0.51), and medium-sized relationships between both subjective norms-intention (r = .033) and PBC-intention (r = 0.46). Intention was also positively correlated with subsequent attendance to cancer screening programmes (r = 0.35). The weakest correlation was observed between PBC and behaviour (r = 0.29). Common to the two meta-analyses was the fact that the strongest association was observed for the attitude-intention relationship, whereas smaller-sized associations were observed for the subjective norm-intention, PBC-intention, PBC-behaviour and intention-behaviour relationships, suggesting that attitudes might be a particularly important construct to be considered in the context of cancer screening behaviour.

More recent evidence in the cancer screening literature further demonstrates the usefulness of SCMs; Farhadifar and colleagues (2016) examined the effectiveness of two-theory based interventions – an intervention based on the Health Belief Model (HBM) and a TPB-based intervention - in improving mammography screening among women who were previously non-adherent to screening. Results indicated that the women in the HBM-based group obtained significantly more mammograms compared to the control group due to greater perceived susceptibility and self-efficacy. A similar pattern of findings was observed

among the TPB-based group for which mammography rates were significantly higher relative to the control group due to greater PBC. Another study by Sieverding, Matterne and Ciccarello (2010) investigated the role of TPB variables to predict uptake of cancer screening (including both prostate cancer and CRC screening) among a sample of 2,426 men and found that, after controlling for sociodemographic variables, attitudes and PBC were predictive of cancer screening intention and that intention was a significant determinant of subsequent screening participation. In addition, Sieverding and colleagues (2010) examined the influence of social norms on cancer screening behaviour in an extended model of the TPB and differentiated between two types of normative social influence – firstly, the *injunctive* norm, which pertains to behaviours which are commonly approved by important others (also known as *subjective* norm) and secondly, the *descriptive* norm, which pertains to what is typically done by others in a given setting (Reno, Cialdini, & Kallgren, 1993). The findings indicated that the injunctive norms construct was an important predictor of intention, however, the descriptive norms construct was able to further increase the variance explained over and above classical TPB variables, suggesting that screening behaviour is influenced both by what important others expect us to do, but also by our perception of how others, comparable to ourselves, behave with regards to cancer screening.

Within the context of CRC screening specifically, two recent UK-based studies have also examined the influence of psychological factors on gFOBT screening participation. Firstly, a study by Lo, Waller, Vrinten, Kobayashi and von Wagner (2015) examined whether social cognitive factors – and specifically, screening knowledge, social norms and perceived barriers – mediated sociodemographic differences in gFOBT uptake among a sample of 1,309 participants and found that all three variables mediated SES differences in uptake. Findings further indicated that differences in uptake by marital status were primarily mediated through social norms and to a lesser extent through knowledge, while age differences were largely unmediated, except for a small mediated effect via social norms. Similarly, the second study examined (Orbell, Szczepura, Weller, Gumber, & Hagger, 2017) whether psychological factors – specifically, perceived severity, perceived vulnerability, response efficacy, response costs and self-efficacy – mediate the relationships between SES and gFOBT uptake, as well as ethnicity

and uptake, among a sample of an ethnic minority, South-Asian population (Hindu-Guajarati/Hindi, Muslim-Urdu and Sikh-Punjabi; *N* = 1,678). Findings indicated that lower self-efficacy and higher perceived response costs fully mediated the relationship between ethnic minority status and gFOBT uptake. Furthermore, the association between ethnicity and gFOBT uptake was partially mediated by SES with the model indicating statistically significant two-path indirect effects via self-efficacy and response costs. Collectively, these findings suggest that shifting out attention towards social cognitive constructs and extending our scientific understanding of the mechanisms through which structural factors, such as SES and race/ethnicity, affect gFOBT screening uptake is important because, unlike sociodemographic factors, social cognitive factors are amenable to change and thus can promote the development of effective and targeted interventions. In turn, such interventions may have important implications for improving overall gFOBT uptake and reducing CRC screening inequalities.

In addition, although much research has focused on the importance of sociodemographic variables in relation to CRC screening, few studies have examined the potential sociodemographic moderators of the relationship between screening intention/uptake and psychosocial variables. One study by von Wagner, Good, Smith and Wardle (2012) investigated whether intentions were moderated by an individual's disposition to evaluate health actions according to the consideration of future consequences (CFC) – that is, their short versus long-term consequences and how this affected consideration of benefits and practicalities of CRC screening. Results indicated that people in the low CFC group were more likely to focus on the practicalities of screening rather than the benefits, whereas for the high SES group the opposite pattern of results was found. Von Wagner and colleagues had originally aimed to assess the role of ethnicity as a potential moderator, however, most of the study participants were from White Ethnic backgrounds and therefore it was not deemed feasible to conduct this analysis. Some studies from the wider cancer screening literature, have also tested moderation models; for instance a study conducted in the US (Perez, Elder, Haughton, Martinez, & Arredondo, 2017) tested whether sociodemographic factors – specifically, education, income and level of acculturation - moderated associations between psychological factors – specifically, perceived barriers to

breast cancer screening, stress and depressive symptoms - and mammography uptake among Latino women. Among other findings, the authors reported that level of education moderated the relationship between perceived barriers and mammography uptake, with an inverse association only among the low-education group. In other words, for women who had less than a high school education, greater perceived barriers were associated with lower screening uptake. After controlling for access to healthcare the moderation effect by education disappeared, suggesting that access to care may have a greater influence on mammography participation than the interaction effect between perceived barriers and education. Overall, very few studies have examined moderation models, therefore additional research is needed to understand the effect of potential sociodemographic moderators of the associations between psychosocial factors and CRC screening uptake and/or intention. Given what is known about the role of SES – including individual-level SES (e.g., education) and area-level SES (e.g., neighbourhood deprivation) - and ethnicity in CRC screening participation (Meissner et al., 2006; Robb, Power, Atkin, & Wardle, 2008; Steele et al., 2009; Von Wagner, Good, et al., 2011), potential moderators that need to be carefully examined include race/ethnicity, education and SES. Such factors are expected to influence the magnitude of any associations between social cognitive constructs and CRC screening intention.

4.1.1. Theoretical Framework

As indicated earlier, the objectives of the present study were to examine three models of influence – direct, mediation and moderation - to elucidate the types of complex relations between sociodemographic variables (e.g., SES, education), psychosocial (e.g., social cognitive constructs) variables and gFOBT screening intention. Social cognitive constructs included in the present analysis were drawn from two theoretical frameworks, and specifically the HBM and the integrated TRA/TPB. The reason the present study focused on these two theoretical frameworks specifically, is three-fold: *firstly*, the qualitative analysis reported in Chapter 3 indicated that social cognitive factors, such as perceived barriers and facilitators (tenets of the HBM) are important determinants of gFOBT screening uptake across all population subgroups. Similarly, the qualitative

analysis highlighted that gFOBT screening among study participants was also largely attributable to TPB-based constructs, including both intrapersonal factors, such as attitudes towards the gFOBT and PBC, as well as contextual factors, such as the perceived importance of CRC screening by participants' social networks, including spouses, family and friends. *Secondly*, the use of the TRA/TPB and the HBM as theoretical frameworks, is further supported by the fact that the majority of theoretically-driven studies included in the meta-analytic review (Chapter 2) incorporated tenets of these models in the development of their proposed interventions to improve uptake, suggesting that such theoretical constructs are largely thought to be associated with gFOBT screening behaviour. Lastly, tenets of both theoretical models have been posited to be relevant to cancer screening. For instance, HBM constructs are known to reflect people's perception of risk, which, as indicated earlier, has important implications for health behaviour change and particularly precautionary behaviour such as cancer screening. On the other hand, attitudes - one of the main constructs of the TRA/TPB - appear to have the strongest positive association with behavioural intention, which was the outcome variable of interest in the present study. Other potentially relevant theories would have been the Protection Motivation Theory (PMT; Rogers, 1975), the Health Action Process Approach (HAPA, Schwarzer, Lippke, & Ziegelmann, 2008) and the Precaution Adoption Process Model (PAPM; Weinstein, 1988), however, it was not deemed feasible to examine all the factors proposed by all these potentially relevant theories.

Given the consensus that attitudes, social norms, PBC and perceived risk and susceptibility are key determinants of behaviour, it was decided that jointly the TRA/TPB and HBM provided the most suitable and comprehensive conceptual framework for examining the multiple pathways between psychosocial constructs, sociodemographic factors and screening intention. To the author's knowledge only two other UK-based studies, whose findings were discussed earlier (i.e., Lo et al., 2015; Orbell et al., 2017) have empirically tested such mediation models within the context of gFOBT screening and these studies did not examine the potential mediating role for the whole range of psychosocial constructs proposed by the HBM and the integrated TRA/TPB model, rather they focused on single constructs or a selection of a few constructs as a substitute for the whole theory. Moreover, to

the author's knowledge none of the existing studies have examined separately the influence different sub-types of attitudes (i.e., cognitive-instrumental and affective-experiential) and subjective norms (i.e., injunctive/subjective and descriptive) in relation to gFOBT screening intention. Lastly, very few studies have tested moderation models examining whether sociodemographic factors, such as SES and education, influence the magnitude of the association between psychosocial variables and screening intention.

The decision for selecting intention as the primary outcome was based on both theoretical and empirical grounds. Firstly, as indicated above, the integrated TRA/TPB model proposes that attitudes and subjective norms influence behaviour only indirectly via their impact on behavioural intent. Furthermore, as indicated earlier in the thesis, empirical research has demonstrated that cues to action, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy/PBC, health knowledge and social support substantially influence intention and behaviour. Given these premises, and on the basis that intention is considered to be a necessary step in the behaviour implementation process, it was decided that intention to participate in gFOBT screening would be a suitable outcome variable to explore the role of sociodemographic and psychosocial variables in relation to CRC screening intention.

Novel to the present study is the consideration of two of the five personality traits proposed in Costa and McCrae's (1992) five-factor model of personality, conscientiousness and neuroticism, as potential mechanisms via which sociodemographic variables may influence screening intention. Personality constructs have consistently been linked to health outcomes with studies reporting that greater conscientiousness is a predictor of longevity and is linked to overall healthier behaviours (Jokela et al., 2013; Kern & Friedman, 2008; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). However, currently there is little known about the role of personality – defined as a largely stable set of traits and characteristics that influences a person's pattern of behaviour, thoughts and feelings – in relation to cancer screening intention. In one study examining the influence of conscientiousness, extraversion and openness in relation to cervical cancer screening, results indicated that greater levels of conscientiousness was associated with fewer perceived barriers to undergoing Pap/smear tests (Hill &

Gick, 2011). A study in Japan, found that lower levels of neuroticism were associated with greater likelihood of regular participation in the National Gastric Cancer Screening Programme (Arai et al., 2009). To the best of the author's knowledge only one UK-based study has examined the links between personality and participation in bowel cancer screening. In this study, by Gale, Deary, Wardle, Zaninotto and Batty (2015) the authors examined whether participation in screening varied according to personality among a sample of 2,681 participants and found that greater conscientiousness was linked with a slightly increased likelihood of participation in bowel cancer screening, with the authors suggesting that further evidence is required to properly gauge the extent to which personality traits might influence participation in the NHS Bowel Cancer screening programme. Therefore, a further aim of the present research was to examine the relationship between these two personality traits and gFOBT screening intention. The focus on conscientiousness and neuroticism alone was justified by the fact that previous research has suggested a stronger association between these two personality traits and health, compared to associations between the remainder personality constructs (i.e., extraversion, agreeableness and openness) and health (Hampson & Friedman, 2008; Turiano et al., 2011). An overview of the two theoretical frameworks followed by the aims of Study 3 are outlined below.

4.1.1.1. The Health Belief Model (HBM)

The HBM represents one of the most widely used conceptual frameworks in health behaviour research and has been extensively used to explain both health behaviour change, as well as a guiding framework for the development of health interventions (Becker, 1974; Skinner, Tiro, & Champion, 2015). The HBM was developed in the 1950's and originated from the need to investigate why people fail to engage with preventive health behaviours (Hochbaum, 1958; Rosenstock, 1960). They key components of the HBM, that have been proposed to predict whether and why people will take action to prevent, detect and control ill health, are: *perceived susceptibility*, which refers to a person's perceived risk for contracting the health condition/illness, *perceived severity*, which relates to beliefs about the seriousness and the consequences of contracting a health condition/illness, *perceived benefits*, which refers to the perception of the positive things or

advantages that could result from engaging with a recommended health behaviour, *perceived barriers* (or *costs*), which describes the perception of the possible obstacles/difficulties and/or negative consequences that would come from engaging with a specific health behaviour, *cue(s) to action*, which concerns the exposure to factors that have capacity prompt action, and *self-efficacy*, which refers to the confidence in one's ability to perform a specific health behaviour. Figure 4.1. below depicts the HBM.

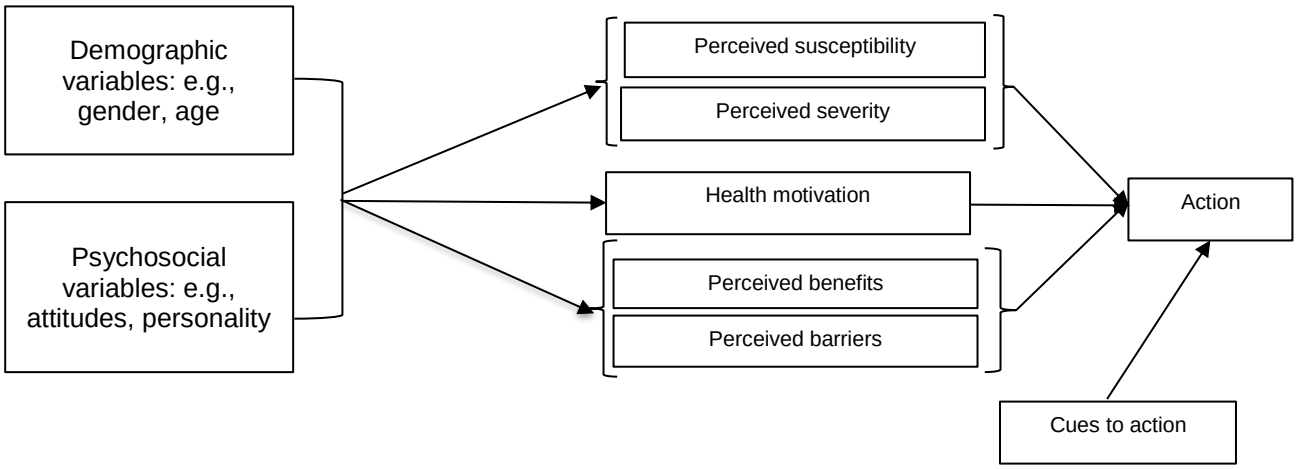


Figure 4. 1. Overview of the HBM

The HBM for understanding gFOBT screening behaviour

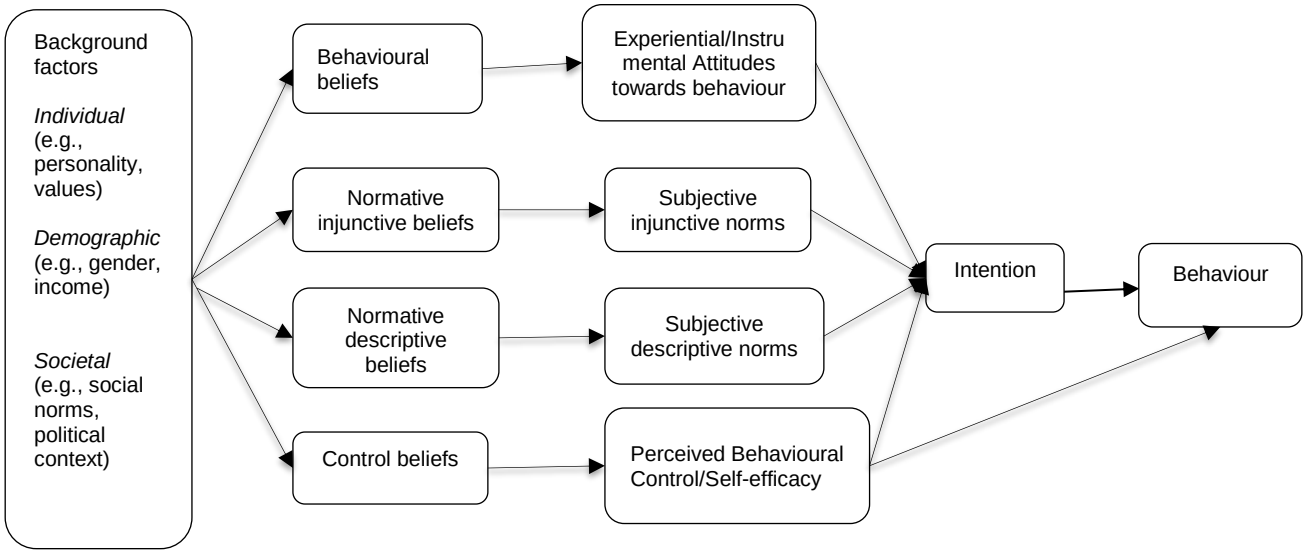
Within the context of bowel cancer screening it could be proposed that all of the HBM constructs could act as potential mediators between sociodemographic variables and screening intention. For instance, people with a family history of CRC might perceive themselves as being more susceptible to bowel cancer and this in turn might motivate participation in screening. Similarly, a family history of CRC could potentially trigger internal cues to action (e.g., experiencing a symptom that may heighten perceived threat of CRC) or external cues to action (e.g., a recommendation from a family member or a physician). Education might be another factor that affects screening intention via HBM-based constructs; for instance, people who are more educated might have greater awareness about the seriousness of bowel cancer (tapping into the construct of perceived severity), which could in turn enhance motivation to screen. Similarly, higher education levels might increase people's PBC in relation to screening - perhaps due to greater

confidence in reading, understanding and engaging with health-related information and activities – thereby resulting in more positive screening behaviours. People with low SES, might perceive more obstacles/barriers and fewer benefits to obtaining screening, due to more difficult and complex life circumstances and therefore may be less motivated to adhere to screening guidelines.

4.1.1.2. The Theories of Reasoned Action and Planned Behaviour (TRA/TPB)

The Theory of Planned Behaviour (TPB; Ajzen, 1991) and its predecessor, the Theory of Reasoned Action (TRA; Ajzen & Fishbein, 1980) are among the most extensively used SCMs that have provided an explanatory framework for conceptualising and predicting a wide range of health behaviours including physical activity (Hagger, Chatzisarantis, & Biddle, 2002), nutrition-related behaviours (Riebl et al., 2015), alcohol consumption (Cooke, Dahdah, Norman, & French, 2016), sun protection behaviour (Starfelt Sutton & White, 2016) and cancer screening (Cooke & French, 2008). As displayed in Figure 4.2, the integrated TRA/TPB model asserts that the most proximal predictor of behaviour is intention, which in turn is influenced by three key components: *firstly*, intention is determined by *attitudes* – which refer to one's favourable or unfavourable evaluation(s)/beliefs about the outcomes or attributes of performing the behavior; *secondly*, intention is influenced by *subjective norms* – which refer to perceptions about normative pressure from important referent individuals to perform or not perform a specific behavior and, *thirdly*, intention is determined by one's *perceived behavioural control* (PBC) – which refers to a person's control beliefs with regards to the presence or absence of factors that inhibit or facilitate behavioural enactment, and the weighting/impact of each of those factors on their ability to perform a specific behaviour. Originally, PBC was not a component of the TRA model, however, it was later added by Ajzen and colleagues (Ajzen, 1991; Ajzen & Driver, 1991; Madden, Ellen, & Ajzen, 1992) to account for factors that are outside an individual's control but that nonetheless have capacity to affect ability to perform a behavior. The addition of PBC to the model led to the formation of the TPB. More recently, Fishbein and Ajzen (2011) proposed that subjective norms incorporate a second component apart from injunctive norms, and included descriptive norms as an additional construct to the model.

Figure 4. 2. Overview of the integrated TRA/TPB model



The integrated TRA/TPB for understanding gFOBT screening behaviour

Within the context of the present study and based on the TRA/TPB model described above, it would be reasonable to suggest that people who hold the belief that CRC screening would be associated with positive health outcomes will have a positive attitude toward participating in gFOBT screening. Conversely, people who do not value or believe that negative outcomes would be associated with CRC screening will have a negative attitude towards gFOBT screening participation. Moreover, people whose loved ones believe they should participate in CRC screening and are heavily influenced by what important others think they should do, would be more likely to hold a positive subjective norm, which in turn would translate into the person being more motivated to meet their expectations and therefore comply with screening recommendations. Finally, individuals who perceive the screening procedure as manageable and uncomplicated may sense that they have greater control over completing the screening kit and this will affect their intention to participate in screening. Alternatively, given that the TPB model proposes that both PBC and intention can be direct and independent predictors of behaviour, it could be suggested that individuals with both greater intention and greater perceived ability to perform the screening would be more likely to adhere to screening recommendations. Finally, the integrated TRA/TPB model proposes that a multitude of background factors, including ethnicity, SES and personality are

distal predictors that are mediated by the more proximal predictors of intention and behaviour (Conner & Norman, 2005). People's different life circumstances are expected to influence tenets of the model (e.g., attitudes), which would in turn be expected to influence intentions and actions.

4.1.2. Study Aims and Objectives

The aim this study was to conduct a population-based survey to explore the psychosocial and sociodemographic determinants of gFOBT screening intention. Specifically, this research aimed to investigate the multiple pathways of influence, firstly by examining the direct effects of psychosocial and sociodemographic variables on screening intention, and secondly by examining indirect effects using mediation and moderation analyses. Due to the limited empirical evidence examining the relationships of psychosocial constructs proposed by both the TRA/TPB and HBM across different subgroups of the British population in relation to gFOBT screening intention, no hypotheses were put forth with regards to the strength and directionality of the associations between psychosocial and sociodemographic constructs and screening intention. Rather the present study was exploratory in nature and aimed to inform the conceptualisation of the role different sociodemographic and psychosocial variables have in predicting gFOBT screening intention and consequently behaviours. Such findings are anticipated to be important in terms of generating testable hypotheses that could be addressed in future empirical research.

Despite not formulating specific hypotheses, it was anticipated that: 1) both sociodemographic variables and psychosocial variables would predict screening intention; 2) tenets of the TRA/TPB and HBM - as well as other psychosocial constructs included in the analyses - would mediate any associations between sociodemographic variables and screening intention; and 3) sociodemographic variables would moderate the relationship between psychosocial factors and screening intention.

In summary the study objectives were:

1. To examine whether sociodemographic and psychosocial characteristics are direct predictors of gFOBT screening intention.

2. To explore whether psychosocial factors mediated any associations between sociodemographic characteristics and gFOBT screening intention.
3. To investigate whether sociodemographic variables moderated any associations between psychosocial constructs and gFOBT screening intention.

4.2. Method

4.2.1. Design

The present study employed a cross-sectional survey design to explore the relationship between sociodemographic and psychosocial factors and gFOBT screening intention.

4.2.2. Participants and Recruitment

Inclusion and exclusion criteria were set prior to recruitment. The inclusion criteria for participants were: *firstly*, to be between the ages of 60 and 74 years; *secondly*, to have received an invitation from the NHS to take part in bowel cancer screening; *thirdly*, to have the ability to read and understand study materials written in English language; and *fourthly*, to have capacity to provide informed consent. An additional requirement for participants that were recruited online was to have access to the internet. Participants were excluded if they had personal history of bowel cancer. As a final exclusion criterion, participants who did not sign the consent form were not included in the research.

Two participant recruitment strategies were implemented; participants were recruited online and in-person. For the online recruitment, the study was advertised across a range of online platforms, including dedicated participation sites (e.g., Social Psychology Network, Online Psychology Research, Call for Participants etc.), electronic community message/bulletin boards and newspapers (e.g., rotary clubs, community council e-bulletins), social media platforms including Facebook, Twitter and LinkedIn. The study was further advertised in dedicated research interest groups available via the above-mentioned social media platforms – for instance, LinkedIn has dedicated pages, such as PhD Survey Support, Psychology Students Network, PhD Students and Supervisors that post research-related content. Moreover, the researcher promoted the study using relevant mailing lists (e.g., Association of Internet Researchers, Psychology Postgraduate Affairs Group). Upon completion of the online survey, participants had the opportunity to

enter a prize draw to win one of four £50.00 Amazon vouchers. The final online medium that was used for participant recruitment was Prolific Academic, which is a crowdsourcing platform tailored for research, which allows potential participants to view a list of ongoing online studies for which they meet the relevant inclusion criteria. Participants completing the survey via Prolific Academic received £1.00 per 10 minutes and were not allowed to make an entry for the prize draw.

Due to the objective of the present research to examine the relationship between sociodemographic variables, psychosocial variables and screening intention it was important that all population subgroups of interest (e.g., low and high SES) were adequately represented within the study sample. For the recruitment of traditionally hard-to-reach populations (i.e., older adults, low-income, BAME populations), it was particularly important to identify and foster collaborations with local community organisations and community stakeholders. Therefore, in-person participant recruitment efforts were implemented by identifying and enlisting the help of community representatives, who held informal leadership roles and were highly respected and socially connected to the communities of interest. Community stakeholders provided the main access to the more vulnerable participants that took part in the present research. Potential participants were approached during weekly events organised for older adults, at local community centres, charitable organisations, churches, and any other organisation across Leeds that served the population of interest. Organisations were selected and approached on the basis that they promoted well-being for older adults by providing activities, projects and services to improve their access to health opportunities. For instance, two of the organisations that were involved in the present research were, Feel Good Factor – an organisation that works with communities across Leeds providing activities, projects and services to improve access to health opportunities for vulnerable and disadvantaged populations – and Black Health Initiative – an organisation that aims to improve equality of access to health and social care within for Black African and Black British populations across Leeds. Partnerships with these organisations and community stakeholders had been initiated during earlier phases of the doctoral research (see section 3.2.2. of Chapter 3 for further details) and were maintained throughout the duration of the PhD. The study was also advertised through the researcher's participation in health

fairs and/or other community outreach activities relating to the prevention and early diagnosis of cancer. Participants who expressed an interest in taking part were provided with a questionnaire pack containing an information sheet (Appendix 4.1), a consent form (Appendix 4.2) and the full questionnaire (Appendix 4.3). Similar to the process described earlier, upon completion of the survey participants that were recruited in-person were asked whether they wished to enter the prize draw for winning Amazon vouchers. Participants who did not have an email account provided either their mobile phone number so that the voucher code could be texted to them or their postal address to which the voucher could be posted.

4.2.3. Measures

A number of factors were considered to influence intention to take part in gFOBT screening. A comprehensive literature review (Chapter 1 and 2) and a series of qualitative interviews (Chapter 3) were conducted, which contributed to the identification of psychological scales and measures used in the present study. As indicated earlier the development of the questionnaire incorporated items from two theoretical frameworks, the HBM and the TRA/TPB, but also included other factors that were considered pertinent to achieving a conceptual understanding of screening intention (e.g., personality constructs).

4.2.3.1. Sociodemographic Variables

The questionnaire included ten items to assess a range of sociodemographic factors including age, gender, education, employment, marital status, area-level socioeconomic deprivation and ethnic background. Participants were asked to self-report whether or not they were registered with a GP, whether English was the primary language they spoke at home and whether they had a family history of bowel cancer. To measure area-level socioeconomic deprivation the 2015 Index of Multiple Deprivation (IMD; Smith et al., 2015) was used for which participants were asked to indicate their postcode, which was then used to calculate a relative score of overall area-level deprivation (a detailed description of the IMD measure is provided in section 3.2.1. in Chapter 3).

4.2.3.2. Screening History Variables

Four items were included to assess gFOBT screening history: ‘Have you received an invitation to participate in bowel cancer screening?’ (1 = Yes, 2 = No);

2) ‘Have you ever used and returned the home screening kit for bowel cancer?’ (1 = Yes, 2 = No); 3) ‘If yes, have you ever hard a result that was unclear or positive?’ (1 = unclear result, 2 = positive result, 3 = both a positive and an unclear result, 4 = negative result each time, 5 = other). In order to assess whether participants were *up-to-date* with gFOBT screening the following item was used: ‘When was the last time you used and returned the home screening kit for bowel cancer?’ (1 = within the last two years, 0 = more than two years ago / not applicable).

4.2.3.3. Psychosocial Variables

HBM-based and TRA-TPB-based items included in the questionnaires were constructed in line with current recommendations (Ajzen & Fishbein, 1980; Conner & Norman, 2015) and based on items used in previous studies in the area of cancer screening using these two SCMs to explore cancer screening behaviour (Champion, 1984; Mason & White, 2008; Michie, Dormandy, French, & Marteau, 2004; Norman & Cooper, 2011; Norman & Hoyle, 2004; Sieverding et al., 2010).

HBM-based Variables. HBM items were developed based on Champion’s (1985) study, which used the HBM to examine breast self-examination behaviour. Participants were asked to state the extent to which they agreed with each item by circling one of seven responses (1 = strongly disagree, 7 = strongly agree).

Perceived Susceptibility. Two items were used to assess *perceived susceptibility* to bowel cancer (e.g., ‘My chances of getting bowel cancer are great’; greater scores denoting higher perceived susceptibility).

Perceived Severity. Two items measured *perceived severity* of bowel cancer (e.g., ‘If I had bowel cancer my whole life would change’; greater scores denoting greater perceived susceptibility).

Perceived Benefits and Perceived Barriers. Two items measured *perceived benefits* (e.g., ‘Doing the bowel cancer screening test will give me peace of mind about it’; higher scores denoting more perceived benefits) and 11 items were used to assess *perceived barriers* to completing and returning the gFOBT screening kit (e.g., ‘I find it difficult to collect the stool samples for the bowel cancer screening test’; greater scores denoting more perceived barriers).

PBC. Four items assessed participants’ confidence in their ability to do the gFOBT screening; items were jointly adapted from Champion (1984) and Fishbein and Ajzen (1980; 2011), as dictated by the HBM and the TRA/TPB respectively, to

assess participants' *self-efficacy* and *PBC*. Previous research has highlighted the great degree of overlap among these two components (Ajzen, 2002a; Manstead & Eekelen, 1998) and therefore in the present study *PBC* was considered to incorporate self-efficacy. Specifically, it has been suggested that *PBC* incorporates two distinct components of self-efficacy, firstly *capacity* and *capability* and secondly, *autonom*y and *controllability*, with the former two constructs relating more strongly to one's perceived confidence about their ability to enact a given behaviour, whereas the latter two constructs refer to one's appraisal of whether enactment of the behaviour is completely reliant on oneself (Trafimow, Sheeran, Conner, & Finlay, 2002). Therefore, *PBC* was measured in terms of all four components; *capacity* was measured by one item ('I am confident that I can do the bowel cancer screening test even if I find it difficult'), as were *capability* ('I am confident that I can do the bowel cancer screening test even if I don't like doing it'), *autonomy* ('Doing the bowel cancer screening test is up to me') and *controllability* ('Doing the bowel cancer screening test is in my control'). Greater scores for the four items denoted greater *PBC*.

Integrated TRA/TPB Variables.

Attitudes. Although attitudes have traditionally been measured using single components (e.g., overall evaluation of attitudes towards a given behaviour), it has been suggested that attitudes comprise of two specific subcomponents; specifically, attitudes are composed of *cognitive- instrumental* evaluations (e.g., beneficial/harmful, wise/foolish, safe/unsafe) and *affective-experiential* evaluations (e.g., pleasant/unpleasant, nice/nasty, gratifying/revolting) towards a particular behaviour. This two-component attitude structure has been empirically supported across a range of attitude-measurement methodologies both specific to TPB-related research (Ajzen, 1991; Ajzen & Driver, 1991, Conner & Armitage, 1998) but also outside the scope of the TPB model (Crites Jr, Fabrigar, & Petty, 1994; Olson & Zanna, 1993) and Ajzen (2002) has suggested that both cognitive and affective attitude items should be included in order to accurately reflect participants' attitudes towards a given behaviour.

Cognitive-instrumental Attitudes*.* Two items, that were adapted from Crites et al (1994), were used to assess '*cognitive-instrumental attitudes'* along 7-point semantic differential scales with the extreme anchors: useful-useless and

beneficial-harmful (e.g., ‘Doing the bowel cancer screening test is useful-useless’). The two items were reverse-coded so that higher scores indicated more positive attitudes.

Affective-experiential Attitudes. Similar to above, two items adapted from Crites et al (1994) were used to assess *‘affective-experiential attitudes’* along 7-point semantic differential scales with the extreme anchors: pleasant-unpleasant and disgusting-not disgusting (e.g., ‘Doing the bowel cancer screening test is pleasant-unpleasant’). The pleasant-unpleasant sematic differential item was reverse-coded so that higher scores reflected more positive attitudes.

Behavioural Beliefs. The TRA/TPB proposes that consideration about the behavioural outcomes influences attitudes towards that behaviour (Ajzen, 2002; Fishbein & Ajzen, 2011). Two items on 7-point Likert scales (1 = disagree strongly, 7 = agree strongly) were used to assess behavioural beliefs about positive outcomes (i.e., *positive behavioural beliefs)* associated with CRC screening (‘Doing the bowel cancer screening test would help keep me healthy for my loved ones’ and ‘Doing the bowel cancer screening test would help prevent me from needing painful treatment’; higher scores denoted more positive attitudes).

Behavioural beliefs about negative outcomes (i.e., *negative behavioural beliefs*) associated with CRC screening were assessed using one item (‘Doing the bowel cancer screening test does not guarantee I won’t get bowel cancer in the future’; higher scores reflected more negative attitudes).

Subjective Norms. As mentioned earlier in the chapter, previous research has emphasised the need to distinguish between *injunctive* and *descriptive* subjective norms as both are considered to have unique effects on behaviour (Rhodes & Courneya, 2003). Therefore, one item was used to assess *injunctive norms* (‘People who are important to me want me to do the bowel cancer screening test’) and another to assess ‘*descriptive norms*’ (‘People who are important to me have done the bowel cancer screening test’). Higher scores denoted higher subjective norms.

Knowledge. CRC knowledge was measured by two sections that firstly, assessed *knowledge of symptoms* indicative of CRC and secondly, *knowledge of risk factors* that are known to increase the likelihood of developing CRC. The development of the symptoms and risk factors awareness scales were informed by

previous research in the cancer screening literature (Forbes et al., 2013; Low, Simon, Waller, Wardle, & Menon, 2013; Wong et al., 2013). Knowledge was assessed by asking participants 'What are the symptoms of bowel cancer?' and 'What are the risk factors for bowel cancer?'. With regards to assessing knowledge about CRC symptomatology, participants were presented a list of 10 symptoms – including, blood in the stool, change of bowel habit, diarrhoea or constipation, pain in abdomen, pain in back passage, bleeding in back passage, bowel does not empty, unexplained weight loss, tiredness , lump in abdomen and rectal bleeding. All of these symptoms are universally agreed, evidence-based, guideline-accepted symptoms of bowel cancer. For each symptom participants identified correctly they were awarded one point, with scores ranging on a continuous scale from 0 (poorest knowledge about CRC symptomatology) to 10 (best knowledge about CRC symptomatology). Similarly, participants were presented with a list of 10 risk factors, all of which are recognised as increasing the risk of CRC and these were: older age, close relative with bowel cancer, drinking alcohol, low physical activity, low intake of fruits or vegetables, high intake of fatty food, red and processed meat, overweight, diabetes and bowel disease. Similar to before, for each risk factor participants selected from the list, they were awarded with one point, with scores ranging on a continuous scale from 0 (poorest knowledge about CRC risk factors) to 10 (best knowledge about CRC risk factors).

Response Efficacy. Response efficacy was measured along a 7-point Likert scale by the following item: 'Using the bowel cancer screening kit will help detect problems so they can be treated earlier' (adapted from Myers et al., 2008; higher scores denoted greater response efficacy).

Perceived Importance of Social Support. This construct was measured by including one item assessing the importance of '*practical social support'* ('I would be more likely to do the bowel cancer screening test if I had practical support from others') and one item assessing the importance of *'emotional social support'* ('I would be more likely to do the bowel cancer screening test if I had emotional support from others'). To the author's knowledge these items have not been used previously in the cancer screening literature, however, they were included due to the evidence in Chapter 3 suggesting that social support was an important factor for increasing the motivation to participate in gFOBT screening.

Health Motivation. The measure of health motivation was based on items developed by Lau, Hartman and Ware (1986) and included four items: 'If you don't have your health you don't have anything'; 'There are many things I care more about than my health'; 'Good health is only of minor importance in a happy life'; 'There is nothing more important than good health'. Higher scores denoted greater health motivation.

Personality Variables. Personality variables were assessed using four items from the Ten-Item Personality Inventory – (TIPI) measure developed by Gosling, Rentfrow and Swann (2003) and included responses to two items measuring conscientiousness (e.g., 'I am dependable and self-disciplined') and two items measuring neuroticism (e.g., 'I am anxious and get easily upset'). Items were reverse-coded so that grater scores indicated greater conscientiousness and greater neuroticism.

Outcome Variable: gFOBT Screening Intention. Two items assessed '*gFOBT screening intention'* to participate in gFOBT screening along 7-point Likert scales ('I intend to do the bowel cancer screening test' and 'I expect to do the bowel cancer screening test'). Higher scores indicated greater intention to participate in screening. This measure has previously been found to have good internal consistency (Schifter & Ajzen, 1985).

4.2.4. Ethics

The present study received ethical approval from the School of Psychology Research Ethics Committee at the University of Leeds (Reference Number: 17-0123; Date of approval: 10/04/2017).

4.2.5. Statistical Analyses

4.2.5.1. Preparing the Data for Analysis

All analyses were conducted using SPSS (IBM SPSS Statistics Version 21). Firstly, in order to prepare the data for analysis, reverse coding was conducted on raw data items that were negatively worded so that higher values for all questionnaire items were consistent. Specifically the two *cognitive-instrumental attitudes* items ('Doing the bowel cancer screening test is useful/useless'; 'Doing the bowel cancer screening test is beneficial/harmful') as well as one of the *affective-experiential attitudes* items ('Doing the bowel cancer screening test is

pleasant/unpleasant') were recoded so that higher values denoted more positive attitudes. Similarly, two of the *health motivation* items ('There are many things I care more about than my health'; and 'Good health is only of minor importance in a happy life') were reverse coded so that higher values denoted higher health motivation. Finally, one *conscientiousness* item ('I see myself as disorganised and careless') and one *neuroticism* item ('I see myself as calm and emotionally stable') were reverse coded so that higher values denoted greater presence for each trait.

Secondly, reliability analysis was conducted to assess whether multiple questionnaire items underlying the same constructs were internally consistent. This was done to reduce the risk of multicollinearity by including similar items separately in subsequent regression models. Cronbach's *alpha* (i.e., α) values were calculated to measure internal consistency for constructs measured by more than two items and Pearson's correlations coefficients were conducted for constructs measured by two items. Items with a Cronbach's alpha value that was 0.70 and above were considered as having relatively high internal consistency and were therefore considered to measure the same constructs (Nunnally & Bernstein, 1994). New scales were computed for *intention,* which originally consisted of two items (r = 0.949, $p < .001$), for *perceived severity,* which consisted of two items (r = 0.592, $p < .001$), perceived susceptibility (two items; $r = .359$, $p < .001$), *positive behavioural beliefs* (two items; $r = .663$, $p < .001$), *social support* (two items; $r = .814$, $p < .001$), *health motivation* (four items, $\alpha = .754$), *conscientiousness* (two items; $r = .723$, $p < .001$), *neuroticism* (two items; $r = .558$, $p < .001$), *cognitive-instrumental attitudes* (two items; $r = .842$, $p < .001$) and *affective-experiential attitudes* (two items; $r = .553$, $p < .001$). Questionnaire items measuring the *perceived barriers* and *perceived benefits* constructs were considered to act as formative indicators of screening intention – that is, all items corresponding to these constructs were considered to have an independent influence on screening intention. For instance, it is possible that screening intention may be determined by a number of formative indicators, each covering a unique and distinguishable aspect of the construct *perceived barriers* (e.g., forgetfulness, embarrassment, lack of time). Therefore, as suggested by previous research (Christophersen & Konradt, 2011; Diamantopoulos & Winklhofer, 2001) , reliability analysis for constructs measured by formative indicators (i.e., perceived barriers and perceived facilitators) was not

considered appropriate because these were expected to reflect conceptually different types of barriers and benefits that might affect intention to take part in screening. Therefore, irrespective of the Cronbach's *α* values, new scales were computed for both *perceived benefits* (consisting of two items) and *perceived barriers* (consisting of 11 items). For the *PBC* construct a new scale was computed consisting of four items (*α* = .897).

Third, the variables *education* and *up-to-date with gFOBT* were dichotomised. Specifically, for the variable *education* the data were coded as either having a university degree (i.e., undergraduate or postgraduate degree) and above or not having a degree (i.e., GCSE O level, GCSE A level, vocational training certificate or diploma or no formal qualification). Participants who responded *othe*r were placed in the *no degree* group as they did not provide evidence of any qualification. For the *up-to-date with gFOBT* variable data was coded as either being up-to-date with gFOBT (i.e., having used and returned a gFOBT kit within the last two years) or not up-to-date with gFOBT (i.e., not having used and returned a gFOBT kit within the last two years). Participants who responded 'other' or 'not applicable' were placed in the 'not up-to-date' group had they not provided any additional qualitative feedback in the designated field of the questionnaire clarifying their screening status.

Fourth, Missing Values Analysis (MVA) was conducted in order to examine the patterns of missing values within the dataset. Overall, only six cases appeared to have at least one missing value across all variables. Due to the small number of cases that had missing values, listwise deletion of cases was considered the most appropriate technique for managing missing values as it was not anticipated that the deletion of six cases (i.e., resulting in a total of *N* = 206 participants included in the analysis) would adversely affect power and therefore the ability to detect meaningful effects.

In order to check that the assumptions for conducting multiple regression were met, a series of analyses were conducted. Firstly, to ensure that the residuals of the regression followed a normal distribution, the Normal Predicted Probability (i.e., P-P) plot was examined and results indicated that the residuals were normally distributed (Hair, Black, Babin, Anderson, & Tatham, 1998; Lewis-Beck & Lewis-Beck, 2015). Secondly, the data was checked for homoscedasticity by plotting the

standardised residuals against the standardised predicted value, with results indicating that residuals were centred around 0 and were randomly distributed across the entire range of the horizontal axis, indicating that the assumptions of normality and linearity were met (Miles & Shevlin, 2001). Lastly, collinearity diagnostic tests were conducted to check for multicollinearity. Specifically, the Tolerance statistic was below 0.1 and the Variance Inflation Factor (VIF) statistic was below 10 for all variables included in regression analyses. Therefore, the assumption of multicollinearity was deemed to have been met (Hair et al., 1998).

4.2.5.2. Statistical Analysis Plan

Firstly, descriptive statistical analysis was conducted in order to examine the sample's sociodemographic characteristics as well as the mean scores, frequencies and percentages for all included variables. Additionally, Pearson's correlation coefficients were calculated to assess the inter-relationships between included variables and to identify any strong, significant correlations to inform subsequent regression and mediation analyses. An initial hierarchical multiple regression analysis was conducted, by firstly, entering into the model the sociodemographic variables and secondly, the psychosocial variables to examine whether each group of variables accounted for a significant amount of variance in gFOBT screening intention.

For the purposes of mediation analyses, multiple linear regression analysis was conducted using Hayes's Macro PROCESS model for SPSS (Version 3), which was installed directly into SPSS. PROCESS is a conditional process modelling programme developed by Preacher and Hayes (2008) and uses an ordinary least squares- or logistic-based path analytical framework to test for both direct and indirect effects (Hayes, 2013). In the present analysis, mediation effects were tested by conducting parallel mediation analysis (PROCESS Model 4) including multiple potential mediators simultaneously. All indirect effects were tested using a bootstrap estimation approach using 95% bias-corrected confidence intervals (CIs) with 5,000 resamples as recommended by Preacher and Hayes (2008). Bootstrapping is a computational method that involves resampling from the data and estimating the indirect effect in each of the resampled datasets (Preacher & Hayes, 2008).

Moderation analysis was conducted through the use of hierarchical multiple regression analyses and the computation of interaction terms between moderator and predictor variables (Aiken, West, & Reno, 1991). Specifically, it was examined whether education and SES interacted with predictor psychosocial/sociodemographic variables in order to influence gFOBT screening intention and to examine the conditions under which the interaction effects occur (i.e., high/low SES, education/no education).

4.3. Results

4.3.1. Sample Characteristics

A total of 206 respondents were included in the present analysis (see Figure 4.3.).

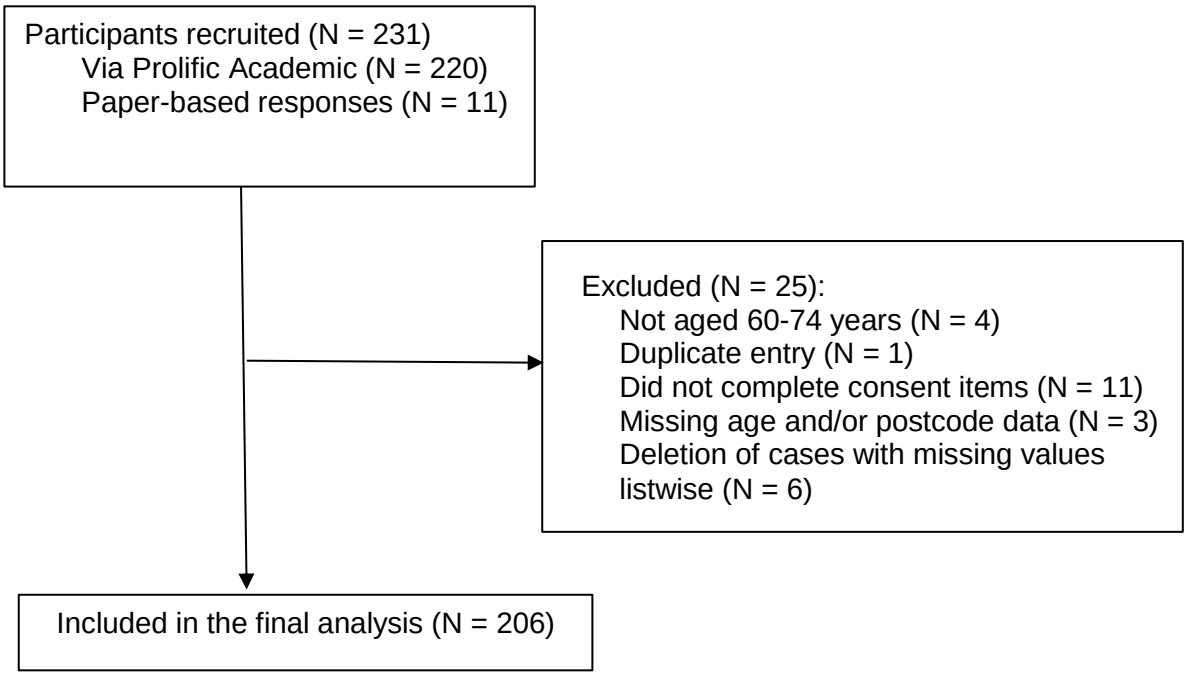


Figure 4. 3. Flow chart of participants included in the survey.

Descriptive data of survey participants are indicated in Table 4.1 below. Survey respondents were predominantly female (62.9%), from a White British/Welsh/Scottish/Irish ethnic background (91.3%) and were aged 60 to 67 (78.9%). The majority of the sample spoke English as their primary language (95.3%) and approximately a fourth of participants held an undergraduate degree

(28.6%). Approximately 33% were retired, 64.8% were married or had a civil partnership, 48.4% reported being in good health. When asked about the number of chronic illnesses participants had, responses indicated that the majority of participants (55.9%) did not have any chronic illnesses, 26.8% had one chronic illness, while 17.3% had two or more chronic illnesses. Approximately one third of the sample (29.1%) lived in deprived areas of the UK, 17.4% lived in moderately deprived areas and the majority (53%) lived in more affluent areas of the country. The majority of participants were from England (80.8%) and did not report having a family history of bowel cancer (88.7%). The majority of participants (79.7%) had received a screening invite and had done the screening (classed as an incident screening episode), and 77.5% of participants were up-to-date with bowel cancer screening at the time of completing the survey. For surveys completed online the average duration for survey completion in minutes was *M* = 13.21, *SD* = 8.87.

Table 4. 1. Demographic and screening history characteristics of survey participants

Characteristics	**Mean (SD) (N = 206)**
Continuous variables	
Age	64.2 (3.92)
Categorical variables	N (%)
Gender	
Male	76 (36.9%)
Female	130 (63.1%)
Ethnicity	
White British/Welsh/Scottish/Irish	192 (93.2%)
BAME[a]	14 (6.8%)
Primary Language	
English	198 (96.1%)
Other	8 (3.9%)
Educational attainment	
Degree or equivalent	104 (50.5%)
No degree	102 (49.5%)
Occupational status	
Unemployed	5 (2.4%)
Homemaker	14 (6.8%)
Retired	68 (33.0%)
Voluntary worker	5 (2.4%)
Modern professional occupation	35 (17.0%)
Clerical occupation	26 (12.6%)

Senior manager	13 (6.3%)
Financial coordinator	2 (1.0%)
Technical & craft occupations	1 (0.5%)
Semi-routine manual & service occupations	6 (2.9%)
Routine manual and service occupations	3 (1.5%)
Middle or junior managers	10 (4.9%)
Traditional professional occupations	18 (8.7%)
Marital status[b]	
Married/Civil partnership	135 (65.9%)
Living with partner	8 (3.9%)
In a relationship	6 (2.9%)
Single	16 (7.8%)
Separated/Divorced	26 (12.7%)
Widowed	14 (6.8%)
Self-reported general health	
Very good	42 (20.4%)
Good	100 (48.5%)
Fair	43 (20.9%)
Poor	17 (8.3%)
Very poor	4 (1.9%)
Chronic Illnesses	
None	116 (56.3%)
1	55 (26.7%)
2	26 (12.6%)
3	7 (3.4%)
4+	2 (1.0%)
IMD Quintile[c]	
1 (most deprived)	25 (12.1%)
2	35 (17.0%)
3	33 (16.0%)
4	48 (23.3%)
5 (least deprived)	65 (31.6%)
Family history of CRC	
Yes	24 (11.7%)
No	182 (88.3%)
Up-to-date with screening	
Yes	147 (71.4%)
No	59 (28.6%)

Notes. [a] Black and Minority Ethnic Group. [b]One case missing (i.e., N = 205) but this variable was not included in subsequent regression analyses. [c] IMD=Index of Multiple Deprivation. Quintiles were based on national cutoffs; areas in quintile 1 are among the most deprived 20% in England, whereas areas in quintile 5 represent the least deprived 20% in England.

4.3.2. Pearson's Correlation Coefficients Analysis

An initial correlation analysis was conducted in order to evaluate the strength and directionality of the relationship between psychosocial measures,

sociodemographic measures and screening intention. Resulting correlation coefficients are shown in Table 4.2, along with means and standard deviations of examined variables.

Table 4. 2. Means, standard deviations and correlation coefficients between intention and psychosocial and sociodemographic variables

Measure	M	SD	Correlations											
			1	2	3	4	5	6	7	8	9	10	11	12
Sociodemographic variables														
1. Gender	0.37	0.48	-	-	-	-	-	-	-	-	-	-	-	-
2. Age	64.22	3.92	.131	-	-	-	-	-	-	-	-	-	-	-
3. Area-level deprivation (IMD)	3.45	1.39	-.046	.075	-	-	-	-	-	-	-	-	-	-
4. Ethnic Group	0.93	0.25	.007	.114	.087	-	-	-	-	-	-	-	-	-
5. Education	0.49	0.50	.128*	-.106	.097	.036	-	-	-	-	-	-	-	-
6. Family history of CRC	0.12	0.32	.130*	-0.17	-.020	.038	-.027	-	-	-	-	-	-	-
7. Up to date with gFOBT	0.71	0.45	.039	.000	.151*	.128	.048	.130	-	-	-	-	-	-
Psychosocial variables														
8. Knowledge 1	6.00	2.93	-.017	-.122	.028	.066	.063	.103	.040	-	-	-	-	-
9. Knowledge 2	5.42	2.67	.043	-.140*	.049	.071	.125	.028	.023	.648***	-	-	-	-
10. Cognitive instrumental attitudes	6.48	1.02	.018	-.109	.016	-.071	.002	.028	.374***	.090	.105	-	-	-
11. Affective experiential attitudes	3.22	0.82	-.104	-.018	.031	.038	.109	-.117	-.037	-.089	-.031	-.246***	-	-
12. Perceived susceptibility	3.20	1.20	.108	-.083	-.014	-.034	-.118	.234**	.037	.030	-.050	.056	.011	-
13. Perceived severity	5.69	1.17	-.133*	-.076	-.023	-.128	-.025	-.053	-.047	.100	.005	-.047	.074	.005
14. Perceived benefits	5.17	1.43	-.031	.020	-.012	-.088	.030	-.040	.146	.020	.015	.406***	0.088	-.027
15. Perceived barriers	2.73	0.92	-.133*	-.028	-.071	-.061	-.129	-.059	-.399***	-.131	-.113	-.510***	.345***	.036
16. PBC	6.35	1.11	-.009	-.185*	.066	-.047	.123	.005	.213**	.202**	.162*	.387***	-.194**	-.118
17. Positive beliefs	5.24	1.48	-.038	-.009	-.107	-.053	-.082	-.050	.109	.144**	.069	.332***	-.101	-.013
18. Negative beliefs	6.54	0.87	-.038	.016	.077	.146*	.017	.034	.124	.121	.065	.098	-.152*	-.100
19. Injunctive norm	5.44	1.62	.061	-.015	.035	-.130	-.058	.099	.205***	.165*	.198**	.350*	-.119	.068
20. Descriptive norm	4.76	2.15	-.023	.036	.180*	.078	.069	.069	.245***	.103	.178*	.139*	-.128	.101
21. Social support	2.76	1.53	-.043	.006	-.058	-.066	-.120	.040	-.148*	-.076	-.044	-.039	.095	.118
22. Health motivation	5.62	1.17	-.078	-.073	.094	-.020	.030	-.079	.058	.090	.058	.139*	.009	-.030
23. Conscientiousness	5.85	1.13	.040	.072	.195*	.059	-.134	.027	.136	.036	-.018	.270***	-.057	.040
24. Neuroticism	2.80	1.43	-.175*	-.147*	-.065	-.009	-.023	.017	.028	-.020	-.102	-.140*	.086	.101
Dependent variable														
25. Intention	6.14	1.56	.074	-.089	.087	.044	.176*	.141*	.602***	.139*	.173*	.630***	-.162*	-.003

Measure	M	SD	Correlations											
			13	14	15	16	17	18	19	20	21	22	23	24
14. Perceived benefits	5.17	1.43	.130	-	-									
15. Perceived barriers	2.73	0.92	.202**	-.265***	-									
16. PBC	6.35	1.11	.262***	.169*	-.232***	-								
17. Positive beliefs	5.24	1.48	.076	.587***	-.262***	.341***	-							
18. Negative beliefs	6.54	0.87	.272***	.051	-.119	.392***	.154*	-						
19. Injunctive norm	5.44	1.62	.054	.294***	-.266***	.225***	.436***	.159*	-					
20. Descriptive norm	4.76	2.15	.017	.137*	-.220***	.067	.108	.111	.416***	-				
21. Social support	2.76	1.53	-.022	.213**	.207***	-.161*	.216**	-.186**	.107	.063	-			
22. Health motivation	5.62	1.17	.064	.076	-.045	.013	.100	.010	-.020	-.081	-.115	-		
23. Conscientiousness	5.85	1.13	.033	.005	-.229***	.200***	.110	.121	.117	.050	-.084	.211***	-	
24. Neuroticism	2.80	1.43	.115	-.141*	.228***	-.075	-.166*	-.093	-.074	-.009	-.009	-.084	-.420***	-
Dependent variable														
25. Intention	6.14	1.56	-.048	.444***	-.535***	.423***	.390***	.242***	.447***	.291***	-.103	.090	.209***	-.176*

Notes. *p<.05, **p<.01, ***p<.001. [1]Gender was coded as 1 = male, 0 = female. [2]IMD quintiles range from 1 (most deprived) to 5 (least deprived). [3]Ethnicity was coded as 1 = White British and 0 = BAME. [4]Degree was coded as 1 = degree and 0 = no degree. [5]Family history of CRC was coded 1 = has family history and 0 = no family history. [6]Being up-to-date with gFOBT screening was coded as 1 = up-to-date and 0 = not up-to-date.

4.3.2.1. Inter-correlations between sociodemographic and psychosocial variables

As shown in Table 4.2, correlation analysis between sociodemographic and psychosocial variables resulted in a number of disparate effects. Results indicated that male gender was weakly and negatively correlated with perceived severity (r = -.133, p < .05), perceived barriers (r = -.133, p < .05) and neuroticism (r = -.175, p < .05). Older age was associated with reduced knowledge for both CRC symptomatology and risk factors, however, only the latter association was statistically significant (r = -.122, p > .05, r = -.140, p < .05 respectively). Older age was also negatively associated with reduced PBC (r =-.185, p < .05) and neuroticism (r = -.147, p < .05). Higher SES was associated with greater likelihood of being up-to-date with gFOBT screening (r = .151, p < .05), greater descriptive normative beliefs (r = .180, p < .05) and higher scores on conscientiousness (r = .195, p < .05). Surprisingly, White British ethnicity was associated with more negative beliefs (r = .146, p< .05) and did not demonstrate any significant relationships with any of the other constructs in the analysis. As expected, having a family history of CRC was associated with greater perceived susceptibility (r = .234, p < .01). Being up-to-date with bowel cancer screening was moderately associated with more positive cognitive instrumental attitudes (r = .374, p < .001) and fewer perceived barriers (-.399, p < .001), and was weakly correlated with greater PBC (r = .213, p < .01), greater injunctive and descriptive normative beliefs (r = .205, p < .001 and r = .245, p <.001 respectively) and less perceived importance of social support (r = -.148. p <.05).

With regards to knowledge about bowel cancer, greater awareness about CRC symptomatology indicated, as expected, a moderate to strong positive association with awareness about CRC risk factors (r = .648, p < .001). Furthermore, knowledge of CRC symptoms was weakly and positively associated with greater PBC (r = .202, p <.001), stronger positive beliefs about screening (r = .144, p < .001) and stronger injunctive normative beliefs (r = .165, p < .05). On the other hand, knowledge about the factors that increase CRC risk were positively correlated to PBC (r = .162, p < .05), injunctive and descriptive normative beliefs (r = .198, p < .01 and r = .178, p<.05 respectively). Cognitive instrumental attitudes indicated moderate and positive correlations with perceived benefits (r = .406, p < .001), PBC (r = .387, p < .001), and positive

beliefs about CRC screening (r = .332, p < .001) and injunctive normative beliefs (r = .350, p < .05). Weaker, positive correlations were observed between cognitive instrumental attitudes and descriptive normative beliefs, health motivation (r = .139, p< .05) and conscientiousness (r = .270, p < .001). As anticipated, a moderate, negative correlation was found for between cognitive instrumental attitudes and perceived barriers (r = -.510, p < .001). Interestingly, there was a negative correlation between cognitive-instrumental and affective experiential attitudes (r = -.246, p < .001) indicating that although participants found gFOBT screening useful and beneficial, they also viewed it as disgusting and unpleasant at the same time. There was a negative association between perceived susceptibility and PBC (r = -.118, p < .05). Perceived severity was positively correlated to perceived barriers (r = .202, p < .01), PBC, (r = .262, p < .001) and negative beliefs (r = .272, p < .001). Perceived benefits were moderately and positively correlated with positive beliefs (r = .587, p < .001) and weakly correlated with PBC (r = .169, p < .05), injunctive normative beliefs (.294, p < .001), descriptive normative beliefs (r = .137, p < .05) and perception about the importance of social support (r = .213, p < .01). As expected, greater perceived benefits were associated with less perceived barriers (r = -.264, p < .001) and lower scores on neuroticism (r = -.141, p < .05). Greater perceived barriers were also significantly associated with less PBC (r = -.232, p < .001), less positive beliefs (r = -.262, p < .001), weaker injunctive and descriptive normative beliefs (r = -.266, p < .001 and r = -.220, p < .001 respectively), lower scores on conscientiousness (r = -.229, p < .001) and were positively correlated with greater perceived importance of social support (r = .207. p < .001) and greater scores on neuroticism (r = .228, p < .001). More positive beliefs were positively correlated with injunctive normative beliefs (r = 225, p < .001) and greater conscientiousness (r = -.229, p < .001), however, results surprisingly indicated that more positive beliefs were at the same time positively correlated with more negative beliefs (r = .392, p < .001). Greater health motivation was associated with greater conscientiousness (r = .211, p < .001) and lower scores on neuroticism (r = -.420, p < .001).

4.3.2.2. Inter-correlations between predictor variables and intention

A number of predictor variables – including sociodemographic and psychosocial variables – were significantly correlated with intention (Table 4.2). Having a degree-level education was associated with grater intention (r = .176, p < .05),

as was having a family history of CRC (r = .141, p < .05). Knowledge about CRC symptomatology and the risk factors of CRC were also significantly positively correlated with intention (r = .139, p < .05 and r = .173, p < .05 respectively). As expected, being up to date with gFOBT screening was strongly, positively correlated with screening intention (r = .602, p < .001). Affective experiential attitudes were negatively associated with intention (r = -.162, p < .05) suggesting that despite finding the test unpleasant, and even disgusting, intention to participate in the future remained high. Unsurprisingly, more perceived benefits were positively associated with intention (r = .444, p < .001) and more perceived barriers were negative associated with intention (r = -.535, p < .001). Similarly, greater PBC was positively associated with intention (r = .423, p < .001). Contradictingly, both positive and negative beliefs about gFOBT screening indicated positive correlation with intention (r = .390, p < .001 and r = .242, p < .001 respectively). Injunctive and descriptive norms were both positively and significantly correlated with intention (r = .447, p < .001 and r = .291, p < .001).

4.3.3. Hierarchical Multiple Regression

Study Objective 1: Examining whether sociodemographic and psychosocial variables directly predict gFOBT screening intention

To test whether sociodemographic and psychosocial constructs predicted screening intention, a two-stage hierarchical multiple regression analysis was conducted with screening intention as the dependent variable. Sociodemographic variables were entered at Stage one of the regression model, followed by psychosocial variables. Regression statistics are reported in Table 4.3.

Table 4. 3. Summary of hierarchical multiple regression analysis for variables predicting screening intention

Variables	*B*	*SE*	*β*	*R*	R^2	R^2 change
Step 1				**0.629**	**0.396**	**-**
Constant	6.492	1.452				
Gender[1]	0.111	0.184	0.034			
Age	-0.029	0.023	-0.074			
Area-level deprivation (IMD)[2]	-0.005	0.063	-0.004			
Ethnicity[3]	-0.186	0.347	-0.030			
Education[4]	0.431	0.176	0.139			
Family history of CRC[5]	0.309	0.273	0.064			
Up-to-date with gFOBT screening[6]	2.028***	0.195	0.590			
Step 2				**0.841**	**0.708**	**0.312*** **
Constant	0.498	1.578				
Gender	0.026	0.140	0.008			
Age	-0.019	0.017	-0.048			
Area-level deprivation (IMD)	-0.019	0.048	-0.017			
Ethnicity	0.134	0.269	0.022			
Education	0.372**	0.139	0.120			
Family History of CRC	0.385	0.209	0.080			
Up-to-date with gFOBT screening	1.204***	0.167	0.350			
Knowledge Symptoms	-0.016	0.029	-0.029			
Knowledge Risk Factors	0.032	0.033	0.055			
Cognitive instrumental attitudes	0.366***	0.087	0.240			
Affective experiential attitudes	0.043	0.087	0.023			
Perceived Susceptibility	-0.010	0.057	-0.008			
Perceived Severity	-0.110	0.063	-0.083			
Perceived Benefits	0.219***	0.061	0.201			
Perceived Barriers	-0.113	0.095	-0.067			
PBC	0.151*	0.076	0.108			
Positive beliefs	0.042	0.063	0.040			
Negative beliefs	0.149	0.084	0.084			
Injunctive norms	0.140**	0.051	0.145			
Descriptive norms	0.028	0.035	0.038			
Social Support	-0.052	0.047	-0.051			
Health Motivation	0.012	0.058	0.009			
Conscientiousness	0.028	0.069	0.021			
Neuroticism	-0.061	0.053	-0.056			

Notes. *N* = 206, B = unstandardised regression coefficient, SE = Standard Error, *β* = Standardised regression coefficient, ΔR^2 = Adjusted R-squared.*p<.05, **p<.01, ***p<.001. [1]Gender was coded as 1 = male, 0 = female. [2]IMD quintiles range from 1 (most deprived) to 5 (least deprived). [3]Ethnicity was coded as 1 = White British and 0 = BAME. [4]Education was based on having a degree-level education and was coded as 1 = degree and 0 = no degree. [5]Family history of CRC was coded 1 = has family history and 0 = no family history. [6]Being up-to-date with gFOBT screening was coded as 1 = up-to-date and 0 = not up-to-date.

The hierarchical multiple regression revealed that, at Step one, sociodemographic variables contributed significantly to the regression model F (7, 198) = 18.53, p < .001 and accounted for 39.6% of the variation in gFOBT screening intention. Introducing the psychosocial variables at Step two explained an additional 31.2% of variation in gFOBT screening intention F (24, 181) = 18.23, p < .001, and this change in R^2 was significant (R^2 change = .312, F = 11.33, p <.001*)*. Together, sociodemographic and psychosocial constructs accounted for 70.9% of the variance in gFOBT screening intention. When all the independent variables were included in stage two of the regression model, only *education*, *up-to-date with gFOBT screening*, *cognitive-instrumental attitudes*, *perceived benefits* and *injunctive norms* were significant predictors of gFOBT screening intention.

4.3.4. Mediation Analyses

Study Objective 2: Exploring potential psychosocial mediators of the association between sociodemographic variables and gFOBT screening intention

A mediation analysis was conducted to examine whether social cognitive constructs mediated the association between sociodemographic variables and gFOBT screening intention. Potential mediators were tested using a multiple mediation model. Inclusion of mediators in the model was decided based on the guidelines set forth by Baron and Kenny (1986), who propose that predictor variables should be significantly correlated with the mediator (at a p < .05 significance level) and that both predictor variables and mediators should be significantly correlated with the dependent/outcome variable. Specifically, based on the Baron and Kenny approach, in order to establish mediation, four criteria must be met: *first,* the predictor variable must be significantly associated with the dependent variable; *second*, the predictor variable must be associated with the mediator; *third*, the mediator must be significantly associated with the dependent variable; and *fourth*, the significant association between the predictor variable and the outcome variable should no longer be significant in order to assume full mediation, or should be reduced in order to assume partial mediation.

According to the Pearson's correlation coefficients presented in Table 4.2, the sociodemographic variables of gender, age, SES (based on IMD quintiles) were not significantly correlated with screening intention, and therefore, based

on the criteria proposed by Baron and Kenny's (1986), these variables could not be included in mediation analyses. Moreover, although education was significantly correlated with intention, it was not correlated with any of the psychosocial variables (i.e., potential mediators in the present analysis). Lastly, family history of CRC was correlated both to intention and two of the social cognitive constructs (i.e., the two perceived susceptibility items), however, none of the perceived susceptibility items were significantly correlated with intention. Therefore, the only sociodemographic variable eligible for inclusion in the multiple mediation model was '*up-to-date with gFOBT',* which related to past screening behaviour. This predictor variable was significantly correlated to screening intention, as well as six social cognitive constructs; '*cognitive-instrumental attitudes'*, '*PBC*', '*injunctive*' and '*descriptive norms'*, '*perceived barriers*' and '*social support'*. All six social cognitive factors were significantly correlated to gFOBT screening intention. Therefore, a parallel mediation model was used to test whether '*up-to-date status with gFOBT'* (*X*) would indirectly influence '*gFOBT screening intention*' (*Y*) through multiple mediators: '*cognitive instrumental attitudes*' (M_1), '*perceived barriers*' (M_2), '*PBC*' (M_3), '*social support'* (M_4), '*injunctive norms*' (M_5), and '*descriptive norms*' (M_6). The significance of the indirect effects was tested using bootstrapping procedures; specifically indirect effects were computed for each of 5,000 bootstrapped samples at a 95% confidence interval (CI).

Parallel Mediation (Model 4)

The parallel mediation tests the potential mediating role of each mediator variable whilst accounting for the shared variance between all the mediator variables include in the model (Hayes, 2013). The parallel mediation model is illustrated in Figure 4.4 below.

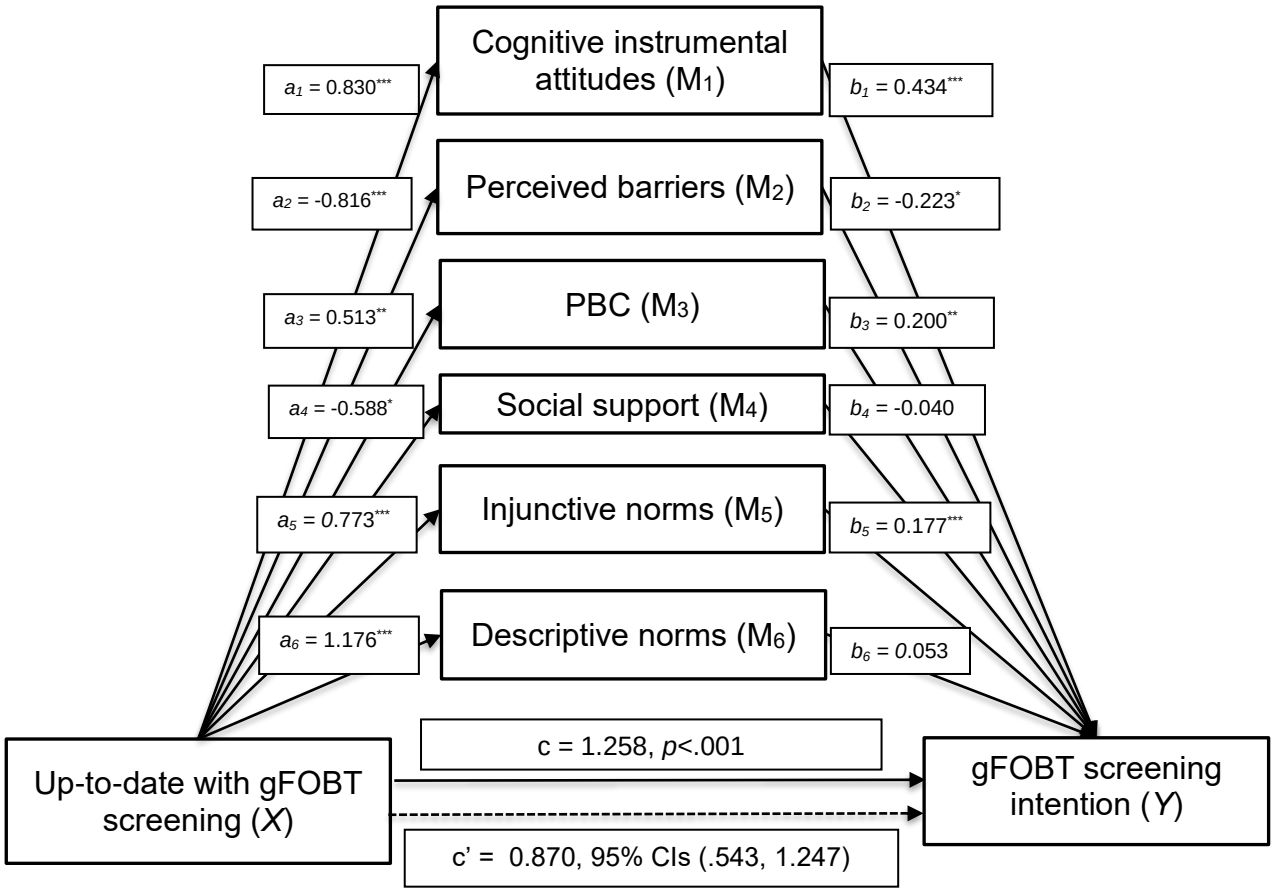


Figure 4. 4. Parallel mediation model including six social cognitive variables as mediators of the effect of up-to-date screening status with screening intention.

*Notes: * p < .05, ** p <.01, *** p < .001; All presented effects are unstandardised regression coefficients (i.e. B); a_n represents the indirect effects of 'up-to-date with gFOBT screening' on social cognitive constructs; 0 is coded as 'not up-to-date' and 1 is coded 'up-to-date'; b_n represents the indirect effects of social cognitive constructs on screening intention; c is the direct (i.e., unmediated) effect of 'up-to-date with gFOBT screening' on screening intention; c is total (i.e., mediated) effect of 'up-to-date with gFOBT screening' on screening intention.*

Results showed that social support (M_4) and descriptive norms (M_6) did not predict screening intention. In order to conduct the parallel mediation without violating the model's assumptions, these two mediators were excluded from the analysis. The 'trimmed' parallel mediation model is illustrated in Figure 4.5.

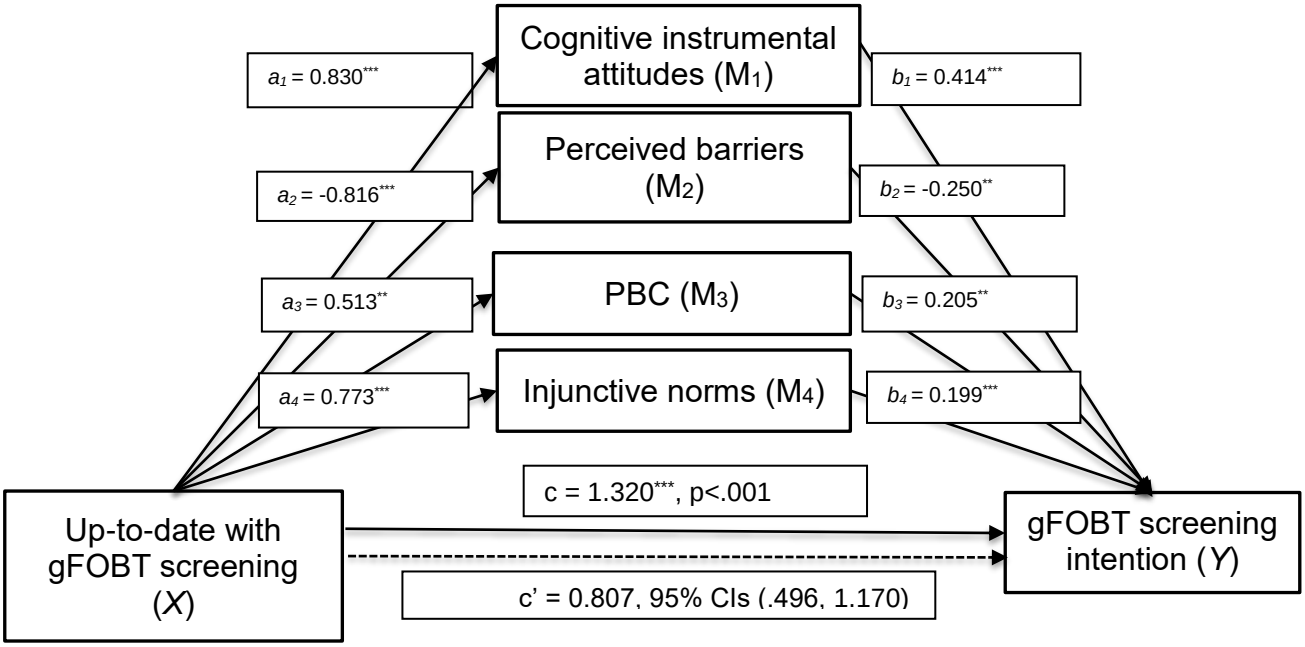


Figure 4. 5. 'Trimmed' parallel mediation model including four psychosocial variables as mediators of the effect of up-to-date screening status with screening intention.

Notes: * p < .05, ** p <.01, *** p < .001; All presented effects are unstandardised regression coefficients (i.e., B); a_n represents the indirect effects of 'up-to-date with gFOBT screening' on social cognitive constructs; 0 is coded as 'not up-to-date' and 1 is coded 'up-to-date'; b_n represents the indirect effects of social cognitive constructs on screening intention; c is the direct (i.e., unmediated) effect of 'up-to-date with gFOBT screening' on screening intention; c is total (i.e., mediated) effect of 'up-to-date with gFOBT screening' on screening intention.

The indirect effect was significant (*B* = .807, 95% BCa CIs: .496, 1.170). Specifically, results from the parallel mediation analysis indicated that up-to-date screening status was indirectly related to screening intention through its relationship with cognitive instrumental attitudes (*B* = .343, 95% BCa CIs: 0.080, 0.731), perceived barriers, (*B* = .204, 95% BCa CIs: 0.010, .455) and injunctive norms (*B* = .153, 95% BCa CIs: 0.035, .306). In contrast, the indirect effect of PBC, albeit marginally, was not different than zero (*B* = .105, 95% BCa CIs: -0.005, .284). Due to the direct effect remaining significant even after inclusion of the mediators into the model, it was concluded that the three mediators partially mediated the relationship between up-to-date screening status and intention to participate in gFOBT screening in the future.

4.3.5. Moderation Analyses

Study Objective 3: Exploring whether sociodemographic factors moderate the associations between psychosocial factors and gFOBT screening intention

Moderation analysis was conducted to investigate the potential moderating effects of two sociodemographic variables, *education* and *SES*, on the association between *screening intention* and other demographic variables included in the analysis, including gender, age, race/ethnicity, CRC-related variables, including having a family history of CRC and being up to date with gFOBT screening, as well as psychosocial variables, including social cognitive and personality constructs. Moderation analysis focused on these two variables in particular, due to the strong links presented in the literature for the association between education, as an indicator of individual-level SES, and screening (e.g., Smith et al., 2016), and neighbourhood deprivation, as an indicator of area-level SES (e.g., von Wagner et al., 2009). It is worth noting, that the present study had initially aimed to examine ethnicity/race as an additional moderator, however, the underrepresentation of BAME participants in the study sample did not allow robust testing of ethnicity/race as a potential moderator and therefore it was not included in the present analysis.

In order to simplify analyses, moderator variables were dichotomised to create groups containing roughly equal numbers of participants. Specifically, in order to examine whether *education* moderated the relationship between predictor variables and *intention* the sample was split into two sub-samples: a) participants who had a degree-level education (N = 106) and b) participants without a degree-level education (N = 106). Separate hierarchical regression models were conducted to examine whether sociodemographic and psychosocial variable predicted *intention* in each *education* sub-sample. Table 4.5 below show results from the hierarchical regression analyses for those with and without a degree-level education and differences in the power of each variable to predict *intention* were tested by examining the significance of the interaction terms between each predictor variable and *education* when controlling for other predictors. The significance of the interaction term (indicating significant differences between the group with and without a degree-level education) is shown in the right-hand column in Table 4.4. A significant

interaction was interpreted as significant differences in unstandardised beta weights between the sub-samples with and without a degree

Table 4. 4. Results from hierarchical regression analyses showing the moderation effect of education (M) on the relationship between demographic and psychosocial constructs (X) and screening intention (Y)

Variables	**No Degree[1]**			**Degree**			***p*-value Interaction (*X* x *M*)**
Moderator	***B***	***SE***	***β***	***B***	***SE***	***β***	
Step 1							
Constant	6.952**	2.198		6.277**	1.771		
Gender[2]	0.141	0.308	0.037	-0.069	0.209	-0.027	
Age	-0.043	0.035	-0.098	-0.011	0.027	-0.033	
Area-level deprivation (IMD)[3]	-0.117	0.101	-0.093	0.123	0.074	0.135	
Ethnic Group[4]	0.395	0.539	0.060	-0.861*	0.426	-0.163	
Family History of CRC[5]	0.274	0.430	0.051	0.213	0.322	0.053	
Up to date with gFOBT[6]	2.344***	0.307	0.612	1.661***	0.230	0.590	
Step 2							
Constant	-2.409	2.165		3.483	2.089		
Gender	0.169	0.232	0.044	-0.030	0.172	-0.030	0.643
Age	0.011	0.026	0.025	-0.032	0.023	-0.076	0.532
Area-level deprivation (IMD)	-0.165*	0.076	-0.133	0.160**	0.062	0.203	0.004***
Ethnic Group	0.130	0.416	0.020	-0.242	0.366	-0.065	0.337
Family History of CRC	0.429	0.315	0.080	0.323	0.261	0.097	0.966
Up to date with gFOBT	1.080***	0.269	0.282	1.305***	0.210	0.462	0.599
Knowledge Symptomatology	-0.080	0.049	-0.137	0.044	0.034	0.108	0.692
Knowledge Risk Factors	0.118*	0.051	0.188	-0.032	0.040	-0.074	0.247
Cognitive Instrumental Attitudes	0.336*	0.142	0.204	0.290**	0.104	0.213	0.037*
Affective Experiential Attitudes	0.011	0.126	0.005	0.052	0.113	0.026	0.103
Perceived Susceptibility	-0.066	0.094	-0.042	-0.021	0.065	0.095	0.611
Perceived Severity	-0.117	0.092	-0.080	-0.066	0.081	-0.042	0.773
Perceived Benefits	0.314**	0.089	0.267	0.165*	0.078	0.178	0.043*
Perceived Barriers	-0.279	0.145	-0.153	0.120	0.125	0.063	0.014*
PBC	0.227	0.118	0.166	0.025	0.102	0.030	0.235
Positive beliefs	-0.009	0.101	-0.008	-0.006	0.079	-0.007	0.181
Negative beliefs	0.230	0.128	0.123	0.080	0.117	0.016	0.425
Injunctive Norm	0.053	0.085	0.047	0.297***	0.060	0.407	0.425
Descriptive Norm	0.073	0.055	0.095	-0.033	0.042	-0.051	0.360
Social Support	0.010	0.073	0.009	-0.092	0.063	-0.097	0.499
Health Motivation	0.158	0.097	0.097	-0.143	0.070	-0.109	0.052
Conscientiousness	0.048	0.124	0.032	-0.032	0.083	0.006	0.793
Neuroticism	0.061	0.092	0.053	-0.173***	0.060	-0.176	0.279

Notes. *N* = 206, *B* = unstandardised regression coefficient, *SE* = Standard Error, *β* = Standardised regression coefficient, *p*<.05, **p*<.01, ***p*<.001. [1] Education was based on whether or not participants had a degree-level education and was coded as 1 = degree and 0 = no degree. [2]Gender was coded as 1 = male, 0 = female. [3]IMD quintiles range from 1 (most deprived) to 5 (least deprived). [4]Ethnicity was coded as 1 = White British and 0 = BAME. [5]Family history of CRC was coded 1 = has family history and 0 = no family history. [6]Being up-to-date with gFOBT screening was

coded as 1 = up-to-date and 0 = not up-to-date. Step 1 'No Degree': R = .641, R^2 =.410, ΔR^2 = .374, Step 2 'No Degree': R = .886, R^2 =.784, ΔR^2 = .723, R^2 change: .374 (p < .001). Step 1 'Degree': R = .637, R^2 =.405, ΔR^2 = .368, Step 2 'Degree': R = .858, R^2 =.736, ΔR^2 = .658, R^2 change: .330 (p < .001).

Results indicated that for 19 independent variables there was no evidence for significant moderation effects (p-value range: .052 - .966). However, *education* significantly moderated the impact of four variables on *screening intention*: *SES* (based on IMD quintiles), *cognitive-instrumental attitudes*, *perceived benefits* and *perceived barriers*. Examination of the unstandardised regression coefficients indicated that *SES* was significantly negatively related to *intention* for participants without a degree-level education (B = -.165, SE = .076, p < .05), whereas for participants with a degree-level education SES was significantly positively related to intention (B = .160, SE = .062, p <.01). These findings suggest that increasing *SES* (i.e., higher IMD scores) was associated with an increase in *screening intention* among participants with a degree-level education, whereas decreasing SES (i.e., lower IMD scores) was associated with stronger *screening intention* among people without a degree-level education. With respect to *cognitive-instrumental attitudes*, examination of the standardised regression coefficients indicated that although *cognitive-instrumental attitudes* were significantly positively related to *intention* in both the 'no degree' (B = .336, SE = .142, p < .05) and the 'degree' sub-samples (B = .290, SE = .104, p < .01), they had a significantly stronger effect in the former compared to the latter group. A similar pattern of findings was observed with regards to *perceived benefits*, which were significantly and positively associated to *intention* in both the 'no degree' (B = .314, SE = .089, p < .01) and the 'degree' sub-samples (B = .165, SE = .078, p < .05), however, the effect of perceived benefits was significantly greater in the former group compared to the latter. *Education* also moderated the relationship between *perceived barriers* and *screening intention*, however, this variable did not significantly predict *intention* in either of the two *education* sub-samples.

A similar strategy to the one described above was used to examine whether '*SES'* (based on IMD data) moderated the relationship between predictor variables and *intention.* For this analysis, the sample was split into two sub-samples: a) participants whose postcodes corresponded to IMD quintiles 1, 2 and 3 were coded as 0 and represented a lower SES group of participants (N = 99) and b) participants whose postcodes corresponded to IMD quintiles 4 and 5 were coded as 1 to represent a higher SES group of participants (N = 113).

Separate hierarchical regression models were conducted to examine whether sociodemographic and psychosocial variables predicted *intention* in each *SES* sub-sample. Table 4.5 shows results from the hierarchical regression analyses, with interaction terms between predictor variables and *SES* being shown in the right-hand side column.

Table 4. 5. Results from hierarchical regression analyses showing the moderation effect of SES (M) on the relationship between demographic and psychosocial constructs (X) and gFOBT screening intention (Y)

Variable	**Low SES[1]**			**High SES**			***p*-value Interaction (*X* x *M*)**
Moderator	***B***	***SE***	***β***	***B***	***SE***	***β***	
Step 1							
Constant	9.141***	2.264		4.011*	1.849		
Gender[2]	0.175	0.263	0.055	0.061	0.250	0.019	
Age	-0.053	0.035	-0.126	-0.015	0.028	-0.038	
Education[3]	0.126	0.248	0.041	0.736***	0.239	0.234	
Ethnic Group[4]	-1.236***	0.447	-0.225	1.229	0.515	0.176	
Family History of CRC[5]	0.217	0.378	0.047	0.581	0.379	0.114	
Up to date with gFOBT[6]	2.015***	0.270	0.617	1.971***	0.265	0.543	
Step 2							
Constant	0.712	2.376		-0.775	2.198		
Gender	0.239	0.209	0.075	-0.085	0.201	-0.026	0.694
Age	-0.022	0.027	-0.052	-0.022	0.023	-0.058	0.366
Education	0.115	0.205	0.037	0.663***	0.194	0.211	0.007***
Ethnic Group	-0.683	0.367	-0.124	1.255**	0.399	0.180	0.005***
Family History of CRC	0.328	0.300	0.071	0.424	0.316	0.083	0.587
Up to date with gFOBT	1.176***	0.245	0.360	1.241***	0.247	0.342	0.291
Knowledge Symptomatology	-0.023	0.044	-0.041	0.030	0.042	0.059	0.233
Knowledge Risk Factors	0.024	0.051	0.040	-0.005	0.045	-0.009	0.363
Cognitive Instrumental Attitudes	0.722***	0.150	0.453	0.212	0.117	0.143	0.846
Affective Experiential Attitudes	-0.034	0.124	-0.018	0.075	0.120	0.039	0.223
Perceived Susceptibility	-0.011	0.090	-0.009	0.009	0.078	0.006	0.980
Perceived Severity	-0.042	0.085	-0.035	-0.207*	0.092	-0.143	0.549
Perceived Benefits	0.133	0.090	0.125	0.336***	0.089	0.303	0.383
Perceived Barriers	0.013	0.144	0.008	-0.015	0.127	-0.009	0.385
PBC	-0.091	0.122	-0.061	0.261*	0.101	0.197	0.278
Positive beliefs	0.120	0.106	0.112	-0.085	0.086	-0.081	0.803
Negative beliefs	0.036	0.126	0.019	0.206	0.111	0.119	0.194

Injunctive Norm	0.091	0.074	0.100	0.158*	0.074	0.156	0.726
Descriptive Norm	0.070	0.052	0.101	0.055	0.051	0.073	0.345
Social Support	-0.057	0.071	-0.057	0.002	0.065	0.002	0.577
Health Motivation	-0.009	0.086	-0.007	0.016	0.084	0.012	0.538
Conscientiousness	0.083	0.099	0.066	0.000	0.102	0.000	0.679
Neuroticism	-0.010	0.077	-0.010	-0.073	0.072	-0.065	0.633

Notes. N = 206, B = unstandardised regression coefficient, SE = Standard Error, β = Standardised regression coefficient, p<.05, **p<.01, ***p<.001. [1]SES was coded based on area-level deprivation derived from IMD data; quintiles 1, 2 and 3 were coded as 0 and reflected lower SES, whereas quintiles 4 and 5 were coded as 1 and reflected higher SES.. [2]Gender was coded as 1 = male, 0 = female. [3]Education was based on whether or not participants had a degree-level education. Having a degree was coded as 1 = degree and 0 = no degree [4]Ethnicity was coded as 1 = White British and 0 = BAME. [5]Family history of CRC was coded 1 = has family history and 0 = no family history. [6]Being up-to-date with gFOBT screening was coded as 1 = up-to-date and 0 = not up-to-date. Step 1 'Low SES': R = .669, R^2 =.448, ΔR^2 = .409, Step 2 'Low SES': R = .886, R^2 =.784, ΔR^2 = .712, R^2 change: .337 (p<.001). Step 1 'High SES': R = .671, R^2 =.451, ΔR^2 = .420, Step 2 'High SES': R = .869, R^2 =.755, ΔR^2 = .691, R^2 change: .304 (p<.001).

Table 4.5 indicated that *SES* significantly moderated the impact of two predictor variables on *screening intention*: *education* and *ethnic group*. Examination of the unstandardised regression coefficients indicated that *education* had a positive (but non-significant) effect on *intention* in the low SES (B = .115, SE = .205, p >.05) and a positive, strongly significant effect in the high SES sub-samples (B = .663, SE = .194, p < .05), indicating that, although *education* is positively associated with *intention* in both groups, its effect is significantly more prominent among the higher SES sub-sample compared to the lower SES sub-sample. Examination of the unstandardised regression coefficients for *ethnic group* indicated a contrasting pattern of findings for the low and high SES sub-samples; for the low SES sub-sample, *ethnic group* was negatively associated, but did not significantly predict, *screening intention* (B = -.683, SE = .367, p < .05), whereas for the high SES sub-sample, *ethnic group* was positively and significantly associated with *intention* (B = 1.255, SE = .399, p < .05). This finding suggests that White-British participants compared to non-White British participants with high SES were significantly more likely to intend to participate in screening, while there were no significant differences in screening intention between White British and non-White British participants for those with low SES.

Past screening behaviour was also examined as a moderator; specifically, the sample was split into: a) participants who were up-to-date with gFOBT screening (N =147) and b) participants who were not up-to-date with gFOBT screening (N = 59). As above, separate hierarchical regression models were conducted to examine whether sociodemographic and psychosocial variables predicted intention in the past *screeners* and *non-screeners* sub-samples. Table 4.6 shows the results from the hierarchical regression analyses

with interaction terms between predictor variables and past screening behaviour being shown in the right-hand column.

Table 4.6. Results from hierarchical regression analyses showing the moderation effect of past screening behaviour (M) on the relationship between demographic and psychosocial constructs (X) and screening intention (Y)

Variables	**Non-screeners[1]**			**Screeners**			***p*-value Interaction (*X* x *M*)**
Moderator	***B***	***SE***	***β***	***B***	***SE***	***β***	
Step 1							
Constant	6.729	4.150		7.969	1.086		
Gender[2]	0.255	0.581	0.060	0.019	0.130	0.013	
Age	-0.034	0.066	-0.071	-0.023	0.017	-0.115	
Area-level deprivation (IMD)[3]	0.032	0.185	0.023	0.029	0.046	-0.052	
Ethnic Group[4]	-0.626	0.847	-0.101	0.179	0.289	0.051	
Family History of CRC[5]	1.497	1.230	0.164	0.095	0.177	0.044	
Degree[6]	0.839	0.536	0.209	0.251*	0.127	0.168	
Step 2							
Constant	1.363	3.379		4.244	1.301		
Gender	-0.449	0.332	-0.106	0.049	0.106	0.032	0.467
Age	-0.012	0.036	-0.024	-0.017	0.013	-0.087	0.686
Area-level deprivation (IMD)	0.068	0.104	0.049	-0.057	0.039	-0.104	0.880
Ethnic Group	-0.312	0.471	-0.050	0.070	0.234	0.020	0.122
Family History of CRC	-0.215	0.663	-0.024	0.172	0.144	0.081	0.786
Degree	0.375	0.324	0.093	0.155	0.103	0.104	0.599
Knowledge Symptomatology	-0.009	0.063	-0.013	-0.003	0.022	-0.012	0.832
Knowledge Risk Factors	0.086	0.072	0.126	0.011	0.025	0.039	0.665
Cognitive Instrumental Attitudes	0.545**	0.164	0.374	-0.013	0.079	-0.012	0.000***
Affective Experiential Attitudes	-0.114	0.217	-0.051	-0.012	0.069	-0.013	0.364
Perceived Susceptibility	-0.024	0.127	-0.015	-0.021	0.043	-0.033	0.236
Perceived Severity	-0.197	0.149	-0.113	-0.074	0.048	-0.118	0.041*
Perceived Benefits	0.478**	0.133	0.393	0.004	0.047	0.008	0.000***
Perceived Barriers	-0.302	0.185	-0.149	-0.052	0.077	-0.055	0.000***
PBC	-0.338	0.204	-0.179	0.136*	0.053	0.201	0.669
Positive beliefs	0.073	0.153	0.056	0.028	0.045	0.054	0.000***
Negative beliefs	-0.026	0.177	-0.011	0.400***	0.065	0.471	0.001***
Injunctive Norm	0.252*	0.114	0.214	0.063	0.038	0.128	0.000***
Descriptive Norm	0.117	0.072	0.125	0.041	0.029	0.114	0.010**
Social Support	0.020	0.101	0.013	-0.024	0.036	-0.049	0.010**
Health Motivation	-0.044	0.133	0.027	0.050	0.047	0.076	0.519
Conscientiousness	0.177	0.179	0.107	-0.007	0.051	-0.011	0.316
Neuroticism	0.027	0.132	0.021	-0.048	0.039	-0.090	0.236

Notes. *N* = 206, *B* = unstandardised regression coefficient, *SE* = Standard Error, *β* = Standardised regression coefficient, *p*<.05, **p*<.01, ***p*<.001. [1] Screeners were defined as being up-to-date with gFOBT screening and were coded as 1 = up-to-date (i.e., used and returned a gFOBT kit within the last two years) and non-screeners were defined as not being up-to-date with gFOBT screening and were coded as 0 = not up-to-date (i.e., not used and returned a

gFOBT kit within the last two years).[2]Gender was coded as 1 = male, 0 = female. [3]IMD quintiles range from 1 (most deprived) to 5 (least deprived). [4]Ethnicity was coded as 1 = White British and 0 = BAME. [5]Family history of CRC was coded 1 = has family history and 0 = no family history. [6]Education was based on whether or not participants had a degree-level education and was coded as 1 = degree and 0 = no degree. Step 1 'Non screeners': R = .326, R^2 =.107, ΔR^2 = .003, Step 2 'Non-screeners': R = .931, R^2 =.867, ΔR^2 = .779, R^2 change: .760 (p < .001). Step 1 'Screeners': R = .229, R^2 =.052, ΔR^2 = .012, Step 2 'Screeners': R = .734, R^2 =.538, ΔR^2 = .452, R^2 change: .486 (p < .001).

Table 4.6 indicated that past screening behaviour significantly moderated the impact of nine predictor variables:

1) Cognitive-instrumental attitudes

Examination of the unstandardised regression coefficients indicated that *cognitive-instrumental attitudes* were significantly positively related to *intention* among the *non-screeners* subgroup (B = .545, SE = .164, p = .001) whereas for the *screeners* subgroup this variable had a negative (but non-significant) effect on *intention* (B = -.013, SE = .079, p > .05).

2) *Perceived severity*

Past screening behaviour moderated the relationship between *perceived severity* and *intention*, showing a negative (but non-significant) association with *intention* in both the *non-screeners* subgroup (B = -.197, SE = .149, p > .05) and the *screeners* sub-group (B = -.074, SE = .048, p > .05).

3) Perceived Benefits

Perceived benefits were significantly positively associated with *intention* in the *non-screeners* subgroup (B = .478, SE = .133, p = .001) and positively, but non-significantly, associated with *intention* in the *screeners* subgroup (B = .004, SE = .047, p > .05).

4) Perceived Barriers

Past screening behaviour also moderated the relationship between *perceived barriers* and *intention*, however this variable did not significantly predict *intention* in either *past screening behaviour* subgroup (B = -.302, SE = .185, p > .05 and B = -.052, SE = .077, p > .05 for the *non-screeners* and *screeners* subgroup respectively).

5) Positive Behavioural Belief

Past screening behaviour also moderated the relationship between *positive behavioural belief* and *screening intention*. Results indicated that *positive behavioural belief* was positively associated with *intention* in both *past screening behaviour* subgroups, however, this variable did not significantly predict *intention* in either subgroup (B = .073, SE = .153, p > .05 and B = .028, SE = .045, p > .05 for the *non-screeners* and *screeners* subgroup respectively).

6) Negative Behavioural Belief

Examination of the unstandardised regression coefficients for *negative behavioural belief* indicated a contrasting pattern of results for the *non-screeners* and *screeners* subgroup; for the former subgroup this variable was negatively associated, but did not significantly predict *intention* (*B* = -0.026, *SE* = .177, *p* > 0.05), whereas for the latter subgroup this variable as positively and significantly associated with *intention* (*B* = .400, *SE* = .065, *p* < .001).

7) Injunctive Norm

Results indicated that *injunctive norm* had a positive and significant association with *intention* in the *non-screeners* subgroup (*B* = .252, *SE* = .114, *p*< .05) and a positive but non-significant effect in the *screeners* subgroup (*B* = .063, *SE* = .114, *p* < .05), indicating that although *injunctive norm* was positively associated with *intention* in both subgroups, its effect was more salient among *non-screeners* compared to *screeners*.

8) Descriptive Norm

Past screening behaviour also moderated the association between *descriptive norm* and *intention* and despite being positively associated with *intention* in both *non-screeners* and *screeners*, this variable did not significantly predict i*ntention* in either subgroup (*B* = .117, *SE* = .072, *p* > .05 and *B* = .041, SE = .029, *p* > .05 for each subgroup respectively).

9) Social Support

Results indicated that *past screening behaviour* moderated the association between *social support* and i*ntention*; however, this variable did not significantly predict *intention* in either subgroup (*B* = .020, *SE* = .101, *p* > .05 and *B* = -.024, SE = .036, *p* > .05 for the *non-screeners* and *screeners* subgroup respectively).

Overall, results from the third moderation analysis (i.e., past screening behaviour as a moderator) indicated there were four variables in total for which there was both a significant moderation effect and at least one significant effect for either the past screeners or past non-screeners group; these were: cognitive instrumental attitudes, perceived benefits, negative behavioural belief and injunctive norm. There were five variables for which there was a significant moderation but no significant effect for either past screening group; these were: perceived severity, perceived barriers, positive behavioural belief, descriptive norm and social support.

4.3.6. Sample Size and Post-hoc Power Analysis

As indicated earlier in the thesis, the final sample size consisted of *N* = 206. Initially, it had been intended to recruit a sample of at least *N* = 242 based on the approach proposed by Tabachnick & Fidell (2007), which states that *N* > *50 + 8M* (where *M* is the number of independent variables). However, due to recruitment challenges relating to targeting and accessing older-adult populations - and particularly older adults from low SES populations and BAME communities - the initial recruitment target was not achieved. Data collection was mainly facilitated using online questionnaires, which presents with additional challenges for older adult populations compared to younger respondents (Weil, Mendoza, McGavin, 2017), which most likely contributed to the smaller sample size included in the present study. Based on the reflections presented in Study 2, it would have been preferable to implement community-based and/or patient-centered recruitment strategies (e.g., translating survey materials, identifying and engaging community stakeholders to access hard-to-reach populations), however, the resources and time required to establish and maintain partnerships with community organisations over the study period were significant and not feasible given the strict timeframe for the completion of the PhD.

A post-hoc power analysis was conducted using the software package G*Power (Faul, Erdfelder, Lang, & Buchner, 2007; Faul, Erdfelder, Buchner, & Lang, 2009). The sample size of *N* = 206 and a total of 24 predictor variables were used for the statistical power analyses. The recommended effect sizes for this assessment were as follows: small (*f 2* = .02), medium (*f 2* = .15), and large (*f 2* = .35) (see Cohen 1977). The *alpha* level used for this analysis was $p < .05$. The post-hoc analyses revealed that the statistical power for this study was .14 for detecting a small effect, .95 for detecting a moderate effect and greater than .99 for detecting a large effect size. Therefore, there was a more than adequate power (i.e., .80) at the moderate and large effect size level, but less than adequate statistical power at the small effect size level.

4.4. Discussion

The present study aimed to examine associations between sociodemographic and psychosocial variables in the context of intention to participate in gFOBT screening. This study used two theoretical frameworks in order to explore these associations, the integrated TPB/TRA and the HBM.

Mediated and moderated effects of these variables on intention were also tested. The findings from this community-based sample of socioeconomically diverse men and women suggested that intention to participate in gFOBT screening was associated with traditional measures of SES, such as education and neighbourhood-level deprivation data, but was also associated with several social cognitive constructs including attitudes, perceived barriers, PBC and subjective norms. Some of these associations varied by education and SES. The next section will provide an overview of the main findings in the context of previous research, describe the implications for interventions and lastly, discuss the strengths and limitations of the study.

4.4.1. Summary of Main Findings

Results indicated that intention to participate in gFOBT screening is underpinned by a combination of sociodemographic and psychosocial variables. Multiple regression analysis showed that, among sociodemographic variables, education and past screening behaviour were direct predictors of screening intention. Furthermore, specific psychosocial constructs also predicted screening intention, including cognitive-instrumental attitudes, perceived benefits, PBC and injunctive norms. Mediation analysis was conducted to explore the underlying mechanisms in the relationship between past screening behaviour and intention, which indicated that psychosocial factors partially mediated this relationship. Specifically, the key social cognitive mediators were cognitive-instrumental attitudes, perceived barriers and injunctive norms. Moderation analysis was conducted to examine whether the strength of the association between psychosocial constructs and intention was impacted by level of educational attainment, SES and past screening behaviour. Results indicated significant interactions between the three moderators and predictor variables. The direct and indirect mediator and moderator effects are discussed in detail in the sub-sections below.

4.4.2 Direct Predictors of Screening Intention

The finding that past screening behaviour predicted screening intention is in agreement with the extensive empirical evidence showing that past behaviour is a fundamental determinant of both intention and prospective behaviour (Bagozzi, 1981; Bagozzi, Wong, Abe, & Bergami, 2000; Orbell, Hodgldns, & Sheeran, 1997). Studies show that past behaviour provides

additional explanatory power in the prediction of behavioural intent; for instance, studies that have explored the implications of past behaviour within the context of the TRA and TPB have shown that past behaviour uniquely predicts intention, even after controlling for other components of the model (Ajzen, 1991; Conner & Armitage, 1998; Ouellette & Wood, 1998) . For example, in an application of the TRA to fast-food consumption, Bagozzi et al (2000) included past behaviour as a co-predictor of intention and behavioural expectations – another facet of volitional behaviour – and found that it added considerably to the amount of variance accounted for in both intention and expectations. Moreover, the addition of past behaviour elicited changes in the strength of the associations in the attitude-intention and subjective norm-intention relationships. The predictive ability of attitudes and norms on intentions and expectations was weakened after inclusion of past behaviour into the model. This attenuation effect has been observed in a number of studies, including research on physical activity (Amireault, Godin, Vohl, & Pérusse, 2008; Hagger, Chatzisarantis, Biddle, & Orbell, 2001; Hagger et al., 2002) and various consumer and health-related behaviours (Kidwell & Jewell, 2003; Kor & Mullan, 2011; McEachan, Conner, Taylor, & Lawton, 2011; Sheeran & Abraham, 2003). Therefore, data from them present analysis suggest that a person's intention to participate in screening is, to an extent, a function of past behaviour. This strong past behaviour-intention association is in agreement with the findings reported in Chapter 3, which highlighted that individuals who had participated in gFOBT screening at least once were more likely to indicate that they would intend to participate in future screening rounds and this was mainly attributed to improved attitudes regarding the screening procedure and increased perception of self-efficacy.

Among sociodemographic variables, educational attainment was the only factor to directly predict screening intention. Unlike findings from previous studies area-level SES, ethnic background and family history did not predict screening intention, although the directionality of associations was in agreement with past reports showing that screening intention and participation are higher among higher SES populations (e.g., von Wagner et al., 2009; 2011), White ethnic groups (e.g., Szczepura, Price & Fumber, 2008) and people with a positive family history of CRC (Rees, Martin, & Macrae, 2008). Nonetheless, the finding that participants with greater educational attainment were more likely to

intend to participate in screening is consistent with a plethora of empirical evidence that shows that more years of education are associated with increased screening uptake (Smith et al., 2016; von Wagner et al., 2009; 2011). It is worth noting, that educational attainment is viewed as an important indicator of social position, where higher level of education is indicative of greater socioeconomic advantage. In fact, it is considered that education is often a better objective indicator of SES compared to income, employment or neighborhood deprivation, because there is usually little fluctuation in educational attainment past the age of 25 years, thereby providing a more stable measure of SES (Carr-Hill, Chalmers-Dixon, Lin, & Britain, 2005). Moreover, education remains largely uninfluenced by illness for adults - unlike income and occupation - and therefore the relationship between education and health can be considered an independent predictor of SES due to not being confounded by other SES-related metrics. Education has also been found to have the strongest effect on mortality in comparison to other SES indicators with studies showing that greater educational attainment often translates into greater likelihood of being employed full-time rather than part-time, obtaining higher status professions, earning more, accruing greater wealth, avoiding financial dept, developing more social connection and engaging in healthier behaviours (Mirowsky & Ross, 2008; Schnittker, 2004). Therefore, in the present analysis it appears that education as an indicator of SES was in line with the expectation that greater SES is associated with greater screening intention. The fact that there was an almost equal number of respondents with a degree- and non-degree level education in the survey sample further strengthens the validity of the present findings. It is worth noting that the correlation between area-level SES (based on IMD) and education was below 0.1 suggesting that they correspond to facets of SES that are independent from one another.

The finding that cognitive-instrumental attitudes were a direct predictor of intention is interesting, especially considering that affective-experiential attitudes were not associated with screening intention in any of the analyses. In fact, this finding lends its support to the notion that the two attitudinal measures are independent from one another and therefore they are likely to differentially impact on intentions, further supporting Ajzen’s (2011) position of including both attitudinal constructs in research. In the context of gFOBT screening in

particular, it appears that attention should be placed on the importance of cognitive-instrumental attitudes in relation to screening intention, rather than affective-experiential attitudes, suggesting that targeting and strengthening people's positive beliefs about the usefulness of screening might be particularly important in increasing their motivation to participate in screening.

The finding that more perceived benefits positively predicted screening intention is unsurprising, given that much empirical evidence that has consistently reported that an increased appreciation of the health benefits is strongly associated with greater participation in screening (e.g., Smith et al., 2016). Similarly, greater PBC was a significant direct predictor of intention. Although there is not much prior evidence examining the association between PBC and intention for gFOBT screening, and some of the available evidence remains inconclusive about its importance within the context of gFOBT screening, it is plausible to suggest that increasing PBC might have important implications for screening uptake. This suggestion is in light of the fact that home-based gFOBT screening is a complex behaviour, which involves a multi-step process and requires a degree of confidence in one's ability to follow instructions, plan and collect the three separate faecal samples and manage negative affects associated with handling faeces. Strengthening perceptions of agency and/or PBC in relation to gFOBT screening might be particularly important among first-time invitees; based on the qualitative evidence in the present thesis, a recurrent finding among past screeners was that completing their first screening kit was the most challenging and that participation became easier with each screening episode. This finding hints that greater ease of completion of the screening kit with each subsequent screening round is partly due to stepped increases in PBC. Currently, there is little evidence about the unique barriers that first-time invitees might face and whether lower PBC is a key driver of behaviour among this specific sub-group, however, given the evidence that past screening predicts future intention and screening participation, it might be particularly timely to test the hypothesis that increased PBC will increase the likelihood of first-time invitees returning their screening kit.

The current findings also indicated that injunctive norms predicted screening intention, while descriptive norms did not. This is in contrast to the findings reported by Sieverdig and colleagues (2010), who reported that descriptive norms explained additional variance in CRC screening intention

beyond injunctive norms. The present study suggests that only injunctive norms – which pertains to what important others expect us to do – are predictive of intention. The fact that descriptive norms did not show an association with intention, may be partly due to the fact that important others may not disclose whether they have completed the screening kit or not due to CRC screening being a sensitive health topic and/or a 'taboo' subject as indicated earlier in the thesis and elsewhere in the CRC literature (Jones, Devers, Kuzel, & Woolf, 2010; Reynolds, Consedine, Pizarro, & Bissett, 2013). Lack of open discussion could in turn lead to an inaccurate indication of how others have acted in relation to the gFOBT screening kit, which is what is measured by descriptive norms. Indeed, findings from the qualitative research indicated that the lack of open communication with regards to the completion of the screening kit was a barrier to screening uptake among non-screeners, whereas past screeners were more likely to have openly discussed about the gFOBT kit with important others. Nonetheless, the present research shows that injunctive social influences play an important role in relation to gFOBT screening intention, and the differential impact of the two types of norms on screening intentions suggests that they should both be considered in future preventive health research. It would be interesting to examine whether the descriptive norms construct is a predictor for other types of cancer screening such as breast and cervical cancer screening, whose benefits have been widely advocated through mass media campaigns and have a long history of being more openly discussed in the public sphere compared to the much less publicity CRC has received (Wakefield, Loken, & Hornik, 2010).

4.4.3. Mediators of the past behaviour-intention relationship

Findings from the mediation analysis indicated that the positive relationship between past screening behaviour and higher intention was partly mediated by cognitive instrumental attitudes, perceived barriers and injunctive norms. Specifically, results revealed that past behaviour indirectly influenced intention via more positive attitudes, an increase in injunctive norms and fewer perceived barriers. With regards to the mediational effect of attitudes, it is worth noting that only cognitive-instrumental attitudes, and not affective-experiential attitudes, were highlighted as a mechanism in the past behaviour-intention relationship. As highlighted above, beliefs about how useful/useless or beneficial/harmful the screening test is (measured by cognitive-instrumental

attitudes) may be more pertinent in the context of cancer screening than beliefs about how pleasant/unpleasant or how disgusting/not disgusting the procedure is. As evidenced by the findings from the qualitative interviews, past non-screeners and past screeners alike perceived the screening process as 'disgusting' and 'embarrassing', however, valuing the benefits of screening seemed to have a buffering effect and promoted screening behaviour among past screeners, suggesting that there is a stronger relationship between cognitive-instrumental attitudes compared to affective-experiential attitudes. To the author's knowledge, apart from the present study, there is currently no research that has evaluated the influence of both of these attitudinal constructs in relation to gFOBT screening, therefore future research should aim to replicate the present findings. Nonetheless, the fact that at least one of the attitudinal measures was a key mechanism in the past behaviour-intention association is consistent with previous studies that have shown that attitudes have the strongest influence in predicting behaviours among TPB variables across a range of health behaviours including among others dietary intake (Riebl et al., 2015), screening uptake (Cooke & French, 2008) and condom use (Armitage & Conner, 2001). Within the context of cancer screening, positive attitudes towards cervical screening have been associated with increased intention to attend Pap/smear testing (Kuitto, Pickel, Neumann, Jahn, & Metelmann, 2010; Ogilvie et al., 2013) as well as CRC screening (McCaffery, Wardle, & Waller, 2003).

The finding that perceived barriers was a mediator of screening intention is consistent with previous findings. A study by Smith and colleagues (2016) examined the association between perceived benefits/barriers and inequalities in cancer screening participation; results indicated that individuals with lower educational attainment were more likely to report higher emotional and practical barriers and were less likely to intend to participate in screening, suggesting that targeting specific barriers could reduce CRC screening inequalities. In the present research perceived barriers were examined through the use of a single scale that was computed from a wide range of barriers previously associated with gFOBT screening uptake, including both practical barriers – for example, concerns about privacy and stool-sample collection - as well as emotional barriers – for example, cancer fatalism, worry and disgust. Given the important role perceived barriers play in relation to gFOBT screening, it might be useful

for future research, to examine practical and emotional barriers separately, which could help reduce existing disparities. Increased specificity about the types of barriers that impact on screening-related decision-making among different population subgroups might be particularly useful for the development of targeted interventions. It would also be beneficial for future research to assess the extent to which the introduction of the FIT will impact on the influence perceived barriers have on both screening intention and participation. Some preliminary evidence from a Scottish study on the attitudes towards the gFOBT versus the FIT (prior to the introduction of the FIT in Scotland) showed that participants reported higher intentions to complete the FIT versus the gFOBT and perceived the FIT as easier to complete and less disgusting (Chambers et al., 2016). Once the FIT is introduced, it would be useful to investigate whether changes in actual screening uptake are directly or indirectly associated with a reduction in practical barriers. Overall, the findings presented here suggest that efforts to remove or reduce the impact of both practical and emotional barriers would have a positive effect on screening intention, which could have promising implications for screening participation.

Interestingly, perceived benefits only had a direct effect but did not indirectly predict screening intention. Furthermore, perceived benefits negatively correlated with perceived barriers, indicating that perhaps the mechanism of influence was through its significant correlation with perceived barriers. The causal pathways through which benefits and barriers influence intention and behaviour to participate in gFOBT screening should further be examined. Similarly, mediation analysis indicated that, although PBC did not significantly mediate the association between past behaviour and screening intention, past behaviour predicted higher PBC. As mentioned earlier, the role of PBC in the context of CRC screening remains ambiguous. For instance, in their meta-analysis Cooke and French (2008) concluded that PBC was not an important predictor of screening behaviour and argued that one's *perception* of behavioural control is unlikely to correspond to *actual* behavioural control when it comes to cancer screening, with only actual control being considered as more likely to translate into increased intention (Armitage & Conner, 2000; Webb & Sheeran, 2006). Still, it is worth noting that mediation analyses indicated that PBC was only marginally non-significant, suggesting that its role in relation to

gFOBT screening intention and behavioural enactment should be further examined.

Evidence that subjective norm is a mediator of the past behaviour-intention relationship is in line with the findings presented in Chapter 3, which reported that the influence of important others was a key motivating factor for repeat CRC participation among past screeners. The finding that subjective norm is both a direct and an indirect predictor of behaviour is consistent with a previous findings showing a positive association between subjective norm and intention, even after controlling for attitudes (Baumann, Brown, Fontana, & Cameron, 1993; Lauver, Nabholz, Scott, & Tak, 1997; Montaño, Thompson, Taylor, & Mahloch, 1997; Zapka, Stoddard, Costanza, & Greene, 1989). These findings suggest that subjective norm is an important determinant of gFOBT screening that should be targeted by future interventions. It might be particularly important to target subjective norms for people who score high on barriers or have negative attitudes, as it is likely that awareness about positive beliefs important others have towards screening could urge people to reconsider their negative beliefs and increase intention to participate in screening.

4.4.3. Education as a Moderator

The results suggested that educational attainment moderated the relationship between SES and intention, as well as each of the relationships between cognitive-instrumental attitudes, perceived benefits, perceived barriers and intention. Higher SES was predictive of stronger intention to participate in gFOBT screening only among participants that had a degree-level education. This finding is consistent with previous evidence that shows that education plays an important role in health behaviours and that differences in educational attainment can influence the perceived value of preventive care and in turn explain differences in preventive care participation (Mirowsky, 2017). Surprisingly, results showed that participants who had lower educational attainment there was an inverse relationship between SES and intention, indicating that greater neighborhood deprivation was associated with greater intention to participate in screening. This contrasts with findings from previous studies that have shown that higher education level is associated with greater cancer screening participation (Bíró, 2013; Lange, 2011; Wübker, 2014), therefore, it is considered unlikely that this finding would be replicated in future research.

There has been growing recognition of the need for further insights about how educational attainment is associated with cancer screening. A recent study conducted in Canada by Jiang and Velasquez-Garcia (2017) analysed secondary data obtained from a sample of 38,863 respondents in order to examine the association between education and CRC screening participation and found that more years of education were associated with an increased likelihood to comply with recommended screening guidelines both for stool-based and endoscopic screening procedures. Similar findings have been observed for mammography adherence; for instance Hubbard and colleagues (2016) reported that mammography uptake increased with stepped increases in educational attainment, with a mammography rate of 58.3%, 69.5% and 80.8% among women with less than a high school education, high school education and college degrees respectively.

Research shows that educational attainment is strongly associated with health literacy, which is thought that it may act as a partial mediator of the contribution of education to screening inequality (Solmi et al., 2015). Indeed, health literacy is considered to be a key contributing factor for socioeconomic and ethnic disparities observed in CRC screening in the UK and worldwide; individuals with low health literacy report limited knowledge of health services, greater difficulty in understanding abstract concepts such as risk and more barriers in understanding procedural information and completing screening (Gimeno-Garcia, 2012; Kobayashi et al., 2014; Power et al., 2009). Health literacy may be an important reason that certain populations have not benefitted equally from cancer screening, however, the measurement of health literacy remains challenging because it encompasses multiple components, including cultural and conceptual knowledge, print literacy skills (i.e., ability to read, write and understand text), numeracy skills (i.e., ability to complete numerical tasks), oral literacy skills (e.g., listening, speaking), and media literacy skills (i.e., the ability to access and process media information including e-health). Future work should investigate the pathways through which low educational attainment influences the uptake of CRC screening uptake and should particularly examine the mediational effects of health literacy to gain a better understanding of the role it plays in the completion of cancer screening.

Given that low educational attainment is likely to impact on knowledge about health services and diseases (von Wagner et al., 2009) it is possible that

individuals with lower educational attainment may benefit from interventions involving public education and awareness campaigns that raise the profile of CRC screening and reiterate the recommendations of its use. Alternatively, the patient-navigation model, which involves individual health education delivered by community health-advisors (e.g., home visits, phone calls) has also shown promising results in the USA for improving knowledge about the benefits of screening and screening participation (e.g., Green et al., 2013), and is particularly effective for ethnic minority and low income populations (Documet et al., 2015). Moreover, the meta-analysis in Chapter 2 also indicated that paper-based materials in addition to telephone outreach was associated with greater intervention effectiveness (e.g., Church et al., 2004; Levy et al., 2013). Since some evidence exists on the effectiveness of higher intensity health communication and patient navigation approaches in increasing CRC screening uptake, future studies should aim to integrate such approaches to investigate the extent of their effect in reducing screening inequalities in the UK.

4.4.4. Area-level SES (IMD) as a Moderator

The results suggested that area-level SES moderated the relationship between both education and intention and ethnic group and intention. Higher educational attainment was predictive of greater intention to participate in screening among both low and high SES groups, however, the effect of greater educational attainment on intention was much more pronounced among the high SES group compared to the low SES group. The fact that higher educational attainment was associated with greater intention for both SES levels further highlights the important influence of education in relation to CRC screening. However, the more prominent positive effect of education on intention among participants with higher SES, is consistent with previous studies reporting that higher SES is associated with overall more favourable cancer screening behaviours. One possibility is that educated individuals from poorer SES backgrounds contend with a unique combination of chronic, frequent and high-impact stressors (e.g., financial instability, social devaluation as a function of SES, fewer employment opportunities) that are not faced by their higher SES peers, which in turn may influence their capacity and motivation to process and engage with health-related behaviours and services in a similar manner that populations with higher SES would. Moreover, unhealthy behaviours are relatively commonplace among individuals with lower

SES due to the stress that low SES causes, suggesting that, apart from the direct causal pathway from low SES to poor health, there is an indirect pathway through the stresses associated with greater socioeconomic disadvantage. Research shows that one process that is important for the conscious enactment of health behaviours is self-regulation defined as “an individual’s ability to guide his/her goal-directed activities over time and across changing circumstances” (Karoly, 1993) and the capacity to modulate thoughts, emotions, behaviour and/or attention. Health behaviours, such as attending regular CRC screenings, require engagement on an ongoing basis and individuals themselves must be invested in the execution of necessary and appropriate behaviours. Research shows that problems in self-regulation are patterned by SES ad people with lower SES may feel that they do not have capacity to commit to health-related goals when there are more urgent concerns to address (Ouwehand, de Ridder, & Bensing, 2009). These findings suggest that it might be important to encourage and support low SES populations to form specific goals in relation to gFOBT screening, for example, through the use of implementation-intentions, which may consequently lead to improvements in self-regulation and help promote healthier screening behaviours. Moreover, interventions focusing on enhancing self-regulation should aim to incorporate strategies that promote goal setting and goal striving whilst taking into account people’s external and/or situational factors such as limited time, money and access to necessary resources and adapting interventional materials. It is unlikely that the same intervention strategies will be effective in high and low SES populations alike, therefore awareness about the particular barriers low SES populations face and linking these contextual circumstances to the application of self-regulatory intervention techniques may strengthen goal commitment among more socioeconomically deprived populations. Future experimental research is warranted to explore whether enhancing goal-directed behaviour using self-regulatory intervention techniques would be useful in improving CRC screening intention and participation among low SES populations.

The interaction between ethnicity and area-level SES indicated that White British participants with higher SES were significantly more likely to intend to participate in screening, whilst there appeared to be no link between ethnicity and intention in the low SES group. Whilst these findings make clear that being from a White ethnic backgrounds bears a significant, positive

association with intention to participate in screening for the high SES group, the lack of evidence regarding the link between intention and ethnicity for the low SES group was surprising. This finding is not consistent with other research, that has shown that IMD scores are correlated with individual makers of SES, including non-white ethnic background, and that high area-level deprivation is associated with worse screening-related outcomes (Moss et al., 2012). The analysis presented in this chapter was limited in that the numbers of participants from BAME backgrounds were too small to examine the effect of ethnicity. There is great need to involve more participants from BAME backgrounds to provide more detailed and accurate examinations of patterns between ethnicity and CRC screening intention and uptake.

4.4.5. Past Screening Behaviour as a Moderator

Results indicated that past screening behaviour moderated the relationship between several psychosocial variables and intention. Specifically, more positive cognitive-instrumental attitudes – a construct measuring beliefs about how useful/useless and beneficial/harmful gFOBT screening is – were predictive of stronger intention to participate in gFOBT screening only among participants who were *not* up-to-date with gFOBT screening. The positive association between attitudes and intention is in agreement with previous empirical evidence that has shown that positive attitudes towards CRC screening are predictive of increased screening intention (McCffrey, Wardle, & Waller, 2003), however it is surprising that this positive relationship was observed only among non-screeners and not both screening sub-groups. This finding is inconsistent with results from Study 2, which highlighted that non-screeners were less likely to intend to participate in future screening rounds partly due to negative attitudes about the screening process. Equally surprising was the finding that perceived benefits and injunctive norm were significantly and positively predictive of intention in the non-screeners subgroup only, whereas weaker, positive associations between each of these variables and intention were observed in the screeners subgroup. These results indicate hat there appears to be a discrepancy between the way in which non-screening participants perceive CRC screening uptake on the one hand (i.e., useful, beneficial, a behaviour that important others would approve) and their actual screening behaviour on the other (i.e., not having completed and returned a screening kit). This discrepancy may be partly explained by the stronger

negative association between perceived barriers and intention observed in the non-screeners subgroup; a finding which is consistent with results from Study 2, which indicated that non-screeners - despite often being aware about the health benefits of CRC screening participation – also were more likely to perceive the screening process as more challenging and unpleasant compared to past screeners. Notably, a number of non-screeners in Study 2 attributed their non-participation predominantly to the unpleasantness of the screening procedure.

Another explanation for the discrepancy between the *attitudes-past screening behaviour* relationship observed in the non-screeners subgroup could be that non-screening participants, despite completing the survey anonymously, felt pressurised to respond in a more socially desirable manner. CRC screening is a behaviour associated with clear social norms – that is, a large proportion of the population will generally perceive CRC screening as positive (Cullati, Charvet-Bérard, & Perneger, 2009; Douma, Uiters, & Timmermans, 2016; Schwartz, Woloshin, Fowler, & Welch, 2004; Waller, Osborne, & Wardle, 2015) – and therefore non-screening participants might have felt inclined to provide responses that do not deviate from the norm, resulting in the observed discrepancy. Items relating to the usefulness or benefits associated with CRC screening might be more sensitive for non-screeners compared to screeners, as it exposes non-screeners to the possibility of providing a socially unacceptable or undesirable response (Tourangeau & Yan, 2007) suggesting that perhaps past non-screeners were more likely to misreport having positive attitudes towards screening compared to past screeners. Perhaps it is this misreporting by past screening behaviour that contributed to an overestimation of the strength of the relationship between attitudes/perceived benefits and intention among non-screening participants.

Results from the present analysis further indicated that, as anticipated, PBC was positively and significantly associated with screening intention in the screeners subgroup – a finding which is in agreement with findings reported in Study 2 suggesting that repeat participation was associated with increases in self-efficacy/PBC -, however, it was surprising that PBC was negatively associated with intention among non-screeners. This finding suggests that past non-screeners with higher PBC had weaker intentions to participate in screening. The direction of this association contrasts the prediction proposed by the TPB/TRA model and it is unlikely this finding would be replicated in future

studies. Given the discrepancies between past screening behaviours and the associations between attitudes, perceived benefits, injunctive norms and screening intention observed in the non-screeners subgroup, it may be useful to test interventions that aim to enhance self-regulation and/or goal setting behaviour in order to motivate participants to act in line with their attitudes/values. Moreover, given the findings from Study 2, which indicated that non-screeners experienced more emotional barriers with regards to the gFOBT screening process compared to screeners, it may be important for interventions to incorporate components relating to emotion regulation. This may help with managing negative affects associated with gFOBT screening often experienced by individuals (e.g., disgust, embarrassment). Some evidence suggests that decision aids and anticipated regret interventions may reduce decisional conflict and promote attitude-behaviour consistency (Dormandy, Hankins, & Marteau, 2006), however, there is little research in the CRC screening literature that has assessed the effectiveness of such interventions among past non-screeners specifically. Therefore, there appears to be a need for studies investigating and testing interventions that target emotional barriers among non-screeners in particular.

4.4.6. Limitations

The limitations of the study should be considered. The first limitation concerns the inclusion of intention as a primary outcome instead of using an objective measure of screening uptake. The present study had originally aimed to objectively measure screening uptake, however, due to NHS organisational restructuring that affected access to the UK's cancer screening databases and a newly implemented process concerning the removal of *Type 2 Objectors* (i.e., a process that concerns patient objections about the types of data that can be provided for purposes outside their primary care) it was not possible to have objective data on uptake. Therefore screening intention was used as a behaviour 'proxy'. Intention formation plays a critical role in the enactment of health behaviours (for an overview see Abraham & Sheeran, 2003; Armitage & Conner, 2000), and meta-analyses have shown that behavioural intention has the strongest relationship with prospective behaviour; for instance, a meta-analysis by McEachan, Conner, Taylor and Lawton (2011) reported a mean correlation of r = .043 between intention and behaviour, and a meta-analysis by Armitage and Conner (2001) reported an intention-behaviour correlation of r =

.047, suggesting that intention is an important predictor of behaviour. The study by McEachan and colleagues further indicated, that even after controlling for past behaviours, intention still emerged as an important predictor of prospective behaviour. Although these findings lend their support to the use of behavioural intention as an outcome variable, research has shown that intentions may not always translate into action, a phenomenon referred to as the 'intention-behaviour gap'. The study would have benefited from including an objective measure of behaviour and it would have been particularly useful to examine whether screening uptake rates varied by differences in the level of screening intention.

Secondly, as indicated earlier, BAME populations were underrepresented in the present sample of participants. It is possible that a different pattern of findings would have been observed had there been a more equal representation of all ethnic groups. Perhaps the lack of significant findings in relation to ethnicity may be due to the small representation of BAME populations in the analysis. Moreover, intention to participate in gFOBT screening was overall high in the present sample and it is unclear whether the observed patterns of findings would hold in a more ethnically diverse population. Nonetheless, previous research examining associations between ethnicity and CRC screening in the UK have reported equally low sample sizes for BAME populations (e.g., Solmi et al., 2015; Lo et al., 2015), which reflects the field-wide challenges in health inequalities research with regards to recruiting and retaining participants from ethnic minority populations (Wendler et al., 2005). Recruitment of ethnic minority participants from the particular age group that was of interest in the present study (i.e., 60-74) represented an additional barrier, due to the low prevalence of BAME populations among older age groups in the national population of England (Office of National Statistics, 2013). Nonetheless, substantial efforts were made during this research in order to target and recruit individual from low SES and BAME backgrounds – including involvement and building rapport with local communities and charitable organisations and use of diverse recruitment strategies (e.g., online and face-to-face).

Increasing research participation among vulnerable subgroups of the populations is imperative, therefore future studies may benefit from the inclusion of multiethnic staff, greater involvement and collaboration with third-sector

organisations that have close links with BAME communities and the use of translated research materials; all actions that are likely to minimise the unique challenges BAME populations face in participating in research (Brannon et al., 2013; Otado et al., 2015). In turn, more ethnically diverse samples will ensure representativeness and generalisability of findings.

Third, the cross-sectional nature of the data does not allow making causal statements about the links between sociodemographic or psychosocial variables and gFOBT screening intention or the direction of these associations. Additionally, the fact that the present analyses were based on correlational data may have led to an overestimation of the magnitude of the associations between theoretical constructs and gFOBT screening intention. Experimental studies that manipulate each of the theoretical constructs separately and examine the impact of the manipulation on screening intention and participation would provide more precise results. An RCT study design could also contribute to the elimination of potential confounding variables.

4.4.7. Conclusions

Despite its limitations, the present study provided useful insights into the processes underlying participants' intention to participate in gFOBT screening. Whilst past studies have examined the associations between sociodemographic and psychosocial constructs in relation to CRC screening, few studies have examined both of these together and used mediation and moderation analyses to explore the potential mechanisms. The present study has identified some important sociodemographic (e.g., education) as well as psychosocial (e.g., cognitive-instrumental attitudes) determinants of gFOBT screening intentions and has further identified some variation by level of educational attainment and area-level deprivation. Most importantly, the findings demonstrated that past behaviour was a significant predictor of gFOBT screening intention and this effect was present across high and low SES populations, as indicated by the results using both individual-level SES measures such as education as well as area-level SES measures such as IMD data. This finding is consistent with results from previous studies that have demonstrated that past experience is an important predictor of intention. This reinforces the need for future studies to consider the importance of addressing the screening experience of invitees, and particularly first-time invitees, as it is possible that a negative screening experience during an individual's first screening round has the capacity to

substantially and negatively affect subsequent screening decisions. Promisingly, findings indicated that the path from past screening behaviour to gFOBT screening intention was partially mediated via three psychosocial constructs: cognitive-instrumental attitudes, perceived barriers and injunctive norms, which are all factors that are modifiable and therefore suitable for being targeted in intervention studies. A next step would be for the present findings to be replicated through experimental studies which manipulate identified constructs in order to test their influence on intention, but most importantly, on screening behaviour. Another recommendation for future research would be to identify specific BCTs that can be used to target the psychosocial constructs that have been identified as potential mechanisms of screening intention and behaviour. Whether different BCTs should be used for different population subgroups remains a matter of continuing research and debate. Chapter 2 of the present thesis has provided some indication about the types of BCTs that could promote CRC screening participation for populations of varying SES, however, more theory-driven interventional research that tests the use of different BCTs is urgently needed in order to elucidate the types of strategies that will help reduce the socioeconomic gradient of screening uptake. In conclusion, the present study utilised two key SCMs and has identified possible sociodemographic and social cognitive pathways through which screening intentions can be affected among a socioeconomically diverse sample in Britain. Some potential strategies to improve screening intention and facilitate screening behaviour among different population subgroups are outlined in the next and final chapter of the present thesis.

CHAPTER 5

General Discussion

5.1. Chapter Summary

The research in this thesis was prompted by the ongoing concern about the inequalities observed in CRC screening uptake. As outlined in Chapter 1, screening and the early detection of asymptomatic cases constitute important elements in the control of CRC. The UK is among the many countries that have successfully implemented population-based CRC screening programmes using the gFOBT screening kit, however screening uptake is not uniform across the population. There is compelling evidence that certain subgroups of the population (e.g., low SES, BAME) have lower participation rates compared to the general population. Further understanding is needed regarding, firstly, the approaches that are most likely to succeed in improving uptake among populations of varying SES, and secondly, the reasons that underpin these differences in uptake. Therefore, the aims of this thesis were to examine the effectiveness of existing interventions to improve CRC screening uptake and to examine the potential impact of sociodemographic and psychosocial factors in relation to gFOBT screening. This final chapter firstly, provides a brief description of the research studies conducted to address the thesis aims, as outlined in Chapter 1; secondly, summarises the key thesis findings alongside a discussion of implications and recommendations for future research; thirdly, provides a proposal of a conceptual framework for increasing CRC screening based on the thesis findings; and lastly, this chapter concludes by providing an overview of the strengths and limitations of the thesis.

5.2. Overview of Thesis Findings

Aim 1: To evaluate the effectiveness of existing interventions to improve CRC screening uptake and to examine whether intervention effectiveness varies by level of SES (Study 1)

In order to address this aim a systematic review of the literature was conducted that included 102 RCTs designed to promote CRC screening uptake. The systematic review and meta-analysis included is the first in the field to examine the effectiveness of a wide range of interventions to increase CRC screening uptake and is also the first to examine effectiveness by level of SES.

Moreover, thus far there has been no prior research that has analysed the effectiveness of particular BCTs using the taxonomy by Michie and colleagues (2013) or that has examined the effectiveness of techniques across different population subgroups. In addition, existing systematic reviews have not systematically assessed the association between reported theory use and the effectiveness of health interventions to increase CRC screening uptake.

Results from the meta-analysis offered clear support for the implementation of health interventions to improve CRC screening uptake; results showed a small, yet statistically significant, positive effect across all included studies. Promisingly, results further indicated that interventions were more effective for low SES groups and this difference in effect was statistically significant compared to non-low SES groups. Results further indicated a reduction in the gap in screening uptake observed between higher and lower SES groups (i.e., the difference in uptake between high and low SES groups was reduced from 19% to 7.5%), thereby suggesting a reduction in screening disparities as a result of health intervention implementation.

Use of subgroup and meta-regression analyses allowed the identification of strategies that were associated with increased intervention effectiveness. The evidence compiled from the meta-analysis revealed a number of strategies that have capacity to promote effective public health interventions for low SES populations. Firstly, with regards to intervention characteristics, it appears that delivering interventions one-to-one rather than in groups, involving clinically trained health professionals (e.g., GPs) in intervention delivery, using materials that combine paper-based information about screening *plus* electronic/technological elements (e.g., web-based interventions, text messages) and including a component that involves telephone outreach, to reiterate the purpose of CRC screening and address barriers, are all intervention components associated with increased intervention effectiveness among low SES groups. Moreover, intervention delivery within a community setting, rather than in primary care, was associated with greater effect sizes.

The content of interventions was assessed through the coding of BCTs present in the experimental condition versus the control condition. The most frequently used BCTs were ‘Information about Health Consequences’, ‘Prompts/Cues’ (i.e., reminders), ‘Social Support’, ‘Adding Objects to the Environment’ (i.e., supplying participants with a free screening kit and therefore

only relevant to USA-based studies) and 'Problem Solving'. Different BCTs were associated with greater CRC screening uptake for the non-low and low SES groups. For non-low SES groups interventions that incorporated arrangements for or the provision of social support (e.g., from friends, relatives, colleagues) indicated significantly larger effect sizes. For the low SES group, instructions about how to perform the behaviour (beyond what participants received as part of their usual care) was associated with greater intervention effectiveness. For both SES groups, providing a free screening kit and incorporating reminders into the intervention were associated with increased intervention effectiveness, although the addition of reminders was significantly more beneficial for the non-low SES group. The meta-analysis also examined the extent of reported theory use using Michie and Prestwich's Theory Coding Scheme (2010) and also examined whether there was any association between intervention effectiveness and theory use. Overall, results indicated that there was limited reporting of theory use in the development and/or evaluation of health intervention to increase CRC screening. The majority of interventions did not make reference to theory and only a third of studies reported using theory to develop the intervention. The theoretical frameworks most frequently used in interventions were the HBM and the Transtheoretical model of change (TTM). Moderation analysis indicated that higher levels of reported theory use were not associated with greater intervention effectiveness.

Aim 2: To identify the perceived barriers and perceived facilitators to gFOBT uptake among different population subgroups (Study 2)

Study 2 explored the barriers and facilitators related to gFOBT screening among an ethnically and socioeconomically diverse sample of both men and women, as well as past screeners and past non-screeners. Many similarities in the factors that facilitated or hindered screening participation were apparent across all subgroups. Common barriers to gFOBT screening expressed by study participants included emotional barriers – for example, experiencing negative affects (e.g., disgust and embarrassment) -, practical barriers – mainly concerning collecting and storing faecal samples -, and the perception of CRC screening as a taboo topic; all factors that had a negative impact on screening intention. Barriers more commonly experienced by low SES and BAME populations included greater cancer fatalism, reduced awareness about the

benefits of screening, poorer health literacy and culture-specific factors (e.g., religiosity). Language barriers appeared to be a key problem for participants whose first language was not English and although participants often expresses willingness to participate in screening, the inability to fully understand and process the information in the screening invitation was a deterring factor. Participants expressed efforts to overcome this barrier by relying on family members to assist but not all participants had this option available. A barrier specific to male interviewees was the lack of familiarity with routine check-ups. Among past non-screeners, barriers that were more prominent included reduced perceived susceptibility, more negative attitudes towards the screening process and a stronger belief that the absence of cancer-related symptomatology was, falsely, an indication of good health. The findings particularly highlighted that reduced perceived severity and susceptibility were associated with greater behavioural avoidance for participants not up-to-date with gFOBT screening. Another barrier among non-screeners was medical mistrust. Issues discussed included the lack of data protection, past negative medical experiences, the gradual privatisation of the NHS and concerns over the cut-off age of people invited to participate in screening (i.e., 60-74 years).

On the other hand, one of the main facilitators of screening participation was the influence of social networks on participants' decision to be screened for CRC. Across all subgroups, a recurrent finding was that participants relied on their spouses, family, friends and wider communities to learn about CRC. Interviewees expressed the view that the sharing of CRC experiences and testimonials from other people that had undergone screening served as a motivator for CRC screening. White British participants were more likely to seek support and discuss screening with their spouses, whereas participants from BAME backgrounds were more likely to seek support and gain information about CRC screening from members within their wider community and/or younger family members with greater levels of acculturation. GP endorsement of CRC screening appeared to be particularly valued by participants from BAME backgrounds and results indicated that GP endorsement/recommendation strongly influenced their decision to participate in screening. Across all study subgroups, knowing someone who either had a positive diagnosis of CRC and/or had died from CRC was a key motivating factor for screening participation. Those who had a familial history of CRC were more likely to

participate in screening and this was often attributed to increased perceived susceptibility. Participants who had lost a loved one to CRC were also more likely to express their appreciation for the NHS and the provision of free cancer screening services. Past screeners reported more positive attitudes towards gFOBT screening, were more likely to form direct links between screening and long-term health and expressed greater motivation to participate in subsequent screening rounds compared to non-screeners.

One of the most salient findings was that past screeners felt that they were morally responsible for their own health choices and considered screening participation to be a behaviour that is reflective of self-care. Lastly, results indicated that participants who were up-to-date with screening perceived their first screening episode as the most challenging, however, ease of completion increased with each subsequent screening round (if completed), perhaps due to increased self-efficacy. Past screeners also seemed to associate less practical and emotional barriers with repeat screening. For instance, participants described feeling less anxiety and increased reassurance with each kit they completed and felt that the likelihood of test results indicating advanced cancer were reduced, which was a factor that strongly facilitated repeat screening compliance.

Aim 3: To explore acceptability of the FIT screening kit (Study 2)

Study 2 also examined participants' initial perceptions of being offered a one-sample stool test soon to be introduced in the UK (i.e., FIT) instead of the three-sample stool test currently used (i.e., gFOBT). Results indicated that overall participants were more likely to express a preference for the FIT. Participants associated the FIT with greater ease of completion and greater convenience due to not having to store the kit in their homes before posting. Male participants in particular expressed that the one-step process involved in completing the FIT would substantially reduce the 'unpleasantness' of the test. Participants also indicated that the FIT would be less time-consuming than the gFOBT. Surprisingly, some participants indicated a preference for the gFOBT over the FIT. This was primarily attributed to the misconception that the number of stool samples collected will affect the diagnostic accuracy of the test and that the collection of one sample could result in a misdiagnosis of cancer.

Aim 4: To assess the direct and indirect pathways via which sociodemographic and psychosocial factors influence gFOBT screening intention (Study 3)

Study 3 presented the results from hierarchical regression, mediation and moderation analyses that were undertaken to examine whether: a) sociodemographic and psychosocial factors directly predicted gFOBT screening intention, b) psychosocial variables mediated the influence of sociodemographic variables on intention, and c) whether sociodemographic factors moderated relations between psychosocial variables and gFOBT screening intention.

Results indicated that both sociodemographic and psychosocial variables uniquely and significantly explained a proportion of the variance in screening intention. Education and past gFOBT screening were significant, direct predictors of screening intention. Moreover, a number of psychosocial variables were found to directly predict screening intention, including cognitive-instrumental attitudes, perceived benefits, PBC and injunctive norm. Mediation analysis indicated that the relationship between past screening behaviour and screening intention was partially mediated by more favourable cognitive instrumental attitudes, fewer perceived barriers and greater injunctive norm. Evidence for the mediating role of PBC indicated there was a trend towards significance. These results suggest that interventions that: a) enhance the formation of more positive attitudes regarding the usefulness of screening, b) that address commonly encountered barriers - whether practical or emotional - and c) prompt invitees to consider the views of important others about screening (e.g., Social Norms Approach) could strengthen screening intention, which could in turn lead to greater screening uptake rates. Findings from the mediation analysis were also consistent with findings reported in Chapter 3, which found that past participation in gFOBT screening was associated, among others, with more positive attitudes regarding the benefits of screening and engaging in preventive healthcare behaviours and was also associated with a reduction in emotional barriers; for instance, past screeners reported feeling less embarrassed with regards to the stool-sampling process, after having completed their screening kit at least once, and less anxious whilst waiting for screening results.

In addition, the importance of injunctive norms as a mechanism to increase screening intention, was also a finding reported in the qualitative analysis. Specifically, participants that were up-to-date with screening repeatedly emphasised the significance of being encouraged by important others to participate in screening. Notably, past screeners highlighted the importance of spousal influences in their decision to participate in gFOBT screening, as well as the importance of wider social networks including friendship groups and people from their local community. The data suggested that spouses influenced the dynamic of each other's health habits and use of the screening kit, indicating that future attempts to increase screening participation may be enhanced by understanding the association between marital/cohabiting relationships and screening behaviours.

Moderation analysis was used to examine whether education (i.e., an indicator of individual-level SES), and neighborhood deprivation (i.e., an indicator of area-level SES) had an impact on the magnitude of any associations between screening intention and other predictor variables included in the analysis. With regards to the moderating effects of education, after controlling for other predictor variables, results indicated that higher SES was associated with a reduction in screening intention among less educated participants, whereas higher SES was associated with an increase in screening intention among more educated participants. Positive cognitive-instrumental attitudes were associated with greater screening intention for both education groups (i.e., no degree versus degree), however, it was surprising that more positive attitudes were associated with significantly greater screening intention among participants without a degree compared to participants with a degree. Similarly, more perceived benefits were associated with greater screening intention in both groups, however, the association between perceived benefits and screening intention was significantly stronger among participants without a degree compared to participants with a degree. This finding contradicts previous research that has shown that greater educational attainment is associated with increased awareness about the benefits of screening and more positive attitudes (Gimeno Garcia, 2012; Jiang et al., 2017; Power et al., 2008). It is known from other research examining the impact of education on cancer-related decision making, that educational attainment is strongly associated with health literacy and that this is a key factor contributing to CRC screening

inequalities, over and above educational attainment (Solmi et al., 2015). However, Study 3 did not include a measure of health literacy and therefore its impact as a potential moderator could not be examined. The inclusion of a health literacy measure might have allowed for a greater resolution of findings with regards to the association between educational attainment, knowledge and screening intention. It is possible that broadly categorising individuals into those with a degree and those without a degree-level education, was insufficient in that it probably did not capture data from populations with very low literacy, given that individuals without a degree-level education are likely to have basic levels of literacy.

5.3. Thesis Reflections and Recommendation for Future Research

The present research has drawn together disparate strands of research to highlight the multiple possible pathways through which sociodemographic and psychosocial factors might impact CRC screening intention and participation. The next section will firstly, provide an overview of certain key findings alongside recommendations for future research, and secondly, briefly describe the development of a conceptual model based on findings from the thesis, which could be used to guide future research focusing on increasing CRC screening participation.

5.3.1. Key Findings, Implications and Future Directions to Improve CRC Screening Uptake

Results from the meta-analytic review provided strong support for the delivery of public health interventions to low SES groups. It is promising that the impact of interventions reduced the observed gaps in screening inequalities. The meta-analysis provided clear directions with regards to specific strategies and intervention characteristics that were associated with greater intervention effectiveness among both low and non-low SES populations. The importance of utilising and specifying BCTs in interventions has been discussed extensively in the literature and the present meta-analysis was the first in the field to evaluate whether specific BCTs increased intervention effectiveness. Despite identifying some effective BCTs for the two SES sub-groups, the lack of detail with regards to the description of interventions in included studies warrants further attention. It was surprising that some of the most efficacious BCTs in behaviour change, including ‘Goal Setting’, ‘Action Planning’, ‘Commitment’, ‘Anticipated Regret’

and ‘Salience of Consequences’ were seldom used in interventions prompting CRC screening. A suggestion for further study would be to explore whether these BCTs increase motivation and/or participation in CRC screening.

Based on the premise that gFOBT screening is a behaviour that is composed of multiple steps and requires careful planning, the BCT ‘Action Planning’ from the ‘Goals and Planning’ category could be suggested as an appropriate technique for supporting individuals in the planning and execution of gFOBT screening. This BCT is thought to facilitate behaviour change by providing a clear pathway in identifying context, duration and frequency of the required behaviour change and provides the opportunity for the individual to develop effective strategies to overcome behavioural barriers. Implementation intentions (IMPs) interventions (synonymous to ‘Action Planning’ interventions) have been shown to be effective across a wide range of behaviours and several studies have associated the use of this BCT with successful health behaviour change (Avery, Flynn, Van Wersch, Sniehotta, & Trenell, 2012; Cradock et al., 2017; Hankonen et al., 2014; Lara et al., 2014). Despite the robust evidence that support its use, IMPs have rarely been applied to cancer screening (Browne & Chan, 2012; Sheeran et al., 2000) and only two studies (also included in Study 1) have applied IMPs to CRC screening (Lo, Halloran, et al., 2014; Neter et al., 2014) and have shown contradictory findings regarding its effectiveness. Therefore, this is one area that merits further research.

As indicated earlier in the thesis, intention is considered a primary determinant of health behaviour and results from previous meta-analyses have indicated strong, positive correlations between behavioural intention and screening uptake (Cooke et al., 2008; Godin et al., 1996). Based on these premises, the use of BCTs that target and strengthen behavioural intention may yield additional gains in CRC screening rates. Findings in Study 2 indicated that increased confidence about the screening procedure was an important motivator for repeat screening participation, suggesting that it may be useful to incorporate in intervention research BCTs that target the construct of self-efficacy/PBC. For instance, BCTs embedded within the ‘Self-belief’ domain of the BCTTv1, such as ‘Verbal Persuasion about Capability’ and ‘Mental Rehearsal of Successful Performance’ could be useful within this context. It must be noted, that findings from the thesis were inconclusive with regards to the exact role of self-efficacy in gFOBT screening; Study 2 indicated that greater

PBC was associated with greater intention to participate, whilst findings in Study 3 suggested that PBC was not a mediator of the association between past screening behaviour and screening intention (albeit marginally non-significant). Nonetheless, gFOBT screening is a behaviour that requires the individual to follow a specific sequence of steps and overcome both practical and emotional barriers, therefore the role of self-efficacy as a potential mechanism of screening uptake and the use of specific BCTs for targeting and improving self-efficacy requires further investigation.

Moreover, the BCT 'Information of Other People's Approval' was not incorporated in any of the interventions included in the meta-analysis, however, the empirical chapters of the thesis emphasised the important influence of participants' environmental context and social milieu on their perception of CRC screening. Specifically, Study 2 suggested that individuals felt more motivated to participate in screening when important others wanted them to, and Study 3 indicated that injunctive norm mediated the association between past behaviour and screening intention, thereby suggesting that this is an important mechanism in the process of screening-related intention formation. Therefore, it is suggested that future studies examine the effectiveness of BCTs that are well-suited for targeting injunctive norm for increasing both screening intention and screening uptake.

Theory proposes that successful enactment of a behaviour has two distinct phases: firstly, a motivational (or intentional) phase, and secondly, a volitional (or post-intentional) phase (Heckhausen & Gollwitzer, 1987). Targeting both phases is thought to be more effective in promoting behaviour change. It is recommended that future interventions test the effectiveness of BCTs that firstly, increase the individual's motivation to engage in CRC screening and secondly, strengthen their capacity to plan their screening behaviour. The integrated motivational-volitional approach represents a promising avenue of inquiry for improving CRC screening uptake and has been shown to be effective for increasing physical activity (Milne, Orbell, & Sheeran, 2002; Prestwich, Lawton, & Conner, 2003), improving dietary behaviour (Prestwich, Ayres, & Lawton, 2008) and reducing alcohol consumption (Hagger et al., 2012). However, the combination of motivational-volitional approaches has not yet been examined within the context of CRC screening. In light of the potentially relevant BCTs for CRC screening behaviour discussed above, it would be useful for future

research to examine whether the combination of: a) the BCT ‘Action Planning’/implementation intentions (IMPs) to assist people in forming plans about completing the gFOBT screening kit with b) the BCT ‘Information of Other People’s Approval’ to inform people about what important others think about CRC screening (e.g., Social Norms Approach) would be effective in improving screening uptake.

Despite present findings highlighting that injunctive norm may facilitate CRC screening behaviour – and particularly, the provision of encouragement and help from important others seems pertinent for the *initiation* of screening - , it is important to consider that not all individuals will have positive social influences. For instance, in individuals whose partner/friends/family are ambivalent or have negative attitudes towards screening, a Social Norms Approach may not be relevant. Indeed, it could have the opposite effect and may act as a barrier to screening participation. Moreover, thesis results indicated that the influence of injunctive norms was patterned by differences in ethnic background; White British participants were more frequently encouraged by spouses/partners to participate in screening whereas BAME populations were more likely to rely for support and encouragement on younger family members. These findings indicate that interventions that aim to target injunctive norms should, if possible, personalise materials to the population to which the intervention is being delivered.

It is worth noting that one of the most commonly used BCTs was ‘Information about Health Consequences’, however, results indicated that this technique was not effective in increasing screening uptake in either SES group (i.e. low and non-low SES); a finding which has been reported in previous research as well (Vestjens, Kempen, Crutzen, Kok, & Zijlstra, 2015). This finding suggests that providing information on screening behaviour-health links was not associated with greater intervention effectiveness. Supposedly, information about the health consequences of screening participation is considered useful for the purposes of enhancing informed decision-making and prompting participants to weigh the *pros* and *cons* of screening participation. Indeed, past research has identified informed decision-making as an important process in achieving better overall health-related outcomes. However, informed decision-making, as well as indicators of informed decisions (e.g., knowledge, deliberation about *pros* and *cons*), are highly dependent on an individual’s

ability to understand and use information. It is highly problematic to assume that all individuals can process and understand information about screening in an analytical and deliberate manner, and therefore it is crucial for national CRC screening programmes to design and implement strategies that increase the ability of those in the poorest socioeconomic strata and those from BAME backgrounds to make decisions that enhance their long-term well-being - including decisions about preventive healthcare such as cancer screening. The implementation of interventions tailored to the needs of specific communities requires an understanding of the important mechanisms – psychological and sociocultural – that underpin screening decisions in a range of life settings.

Moreover, the BCT 'Information about Health Consequences' may be better applied to behaviours that have more immediate outcomes and repercussions for an individual's health. Research suggests that behaviour is less likely to be initiated and maintained for long-term outcomes – which is the case in CRC screening - compared to behaviours that have immediate benefits such as engaging in physical activity. In their paper, Kwasnicka, Dombrowski, White and Sniehotta (2016) highlight that: "Motivation to avoid negative health consequences is hypothesised to be insufficient to maintain preventive behaviour that requires maintained effort" (p.282). Therefore it appears highly unlikely that targeting risk perception simply by providing information about the risks of non-participation in CRC screening will materialise into greater screening uptake, particularly for people that do not make their own long-term health a priority and people who may have to focus on unmet basic needs (e.g., food, housing).

Findings from Study 3 showed that greater perceived severity and perceived susceptibility – both constructs of risk perception - were negatively associated with screening intention. When examined in conjunction with findings from Study 2, it could be suggested that information about the importance of CRC screening might be more salient among individuals who have been personally affected by CRC – for example, through the passing of a loved one. For such individuals, information about the long-term health benefits of CRC screening is likely to be of high personal relevance and therefore it may reinforce motivation to participate in screening. For individuals without such experiences, however, CRC screening might be considered of low personal

relevance, which could lead to a lower motivational response in relation to screening participation.

This section so far has provided recommendations that are actionable for future interventions. It is also important to consider the links between BCTs and the use of theory in the development and/or implementation of interventions. Study 1 indicated that approximately a fourth of included studies mentioned use of theory or a theoretical model in designing the intervention. Although the majority of these studies reported using theory to select and/or develop intervention techniques, only a third reported that all intervention techniques were explicitly linked to at least one theory-relevant construct. Findings indicated that use of theory was not extensive for the majority of studies and the relationship between effectiveness and extent of theory use was weak. This finding contests previous research that has shown that theory-driven interventions may be more effective in changing health behaviours compared to studies not using theory (Glanz et al., 2010). Moreover, previous research has supported the idea that the evaluation and development of complex interventions requires a strong theoretical understanding in order to identify and strengthen mediational links in the causal chain (Craig et al., 2008). Over the last decade, there has been increased interest in linking BCTs with key determinants and/or mediators of behaviour included in SCMs, such as intention and attitudes (Michie, Johnston, Francis, Hardeman, & Eccles, 2008). Michie and colleagues (2008) have argued that successful behaviour change largely relies on: a) specifying the range of techniques available to change the determinants of behaviour and b) developing a basis for selecting relevant techniques to map on to differing determinants of behaviour. The lack of theoretical integration between determinants of behaviour and BCTs in the majority of published studies included in Study 1, indicates a discrepancy between what is recommended scientifically and what is implemented in terms of intervention research. Therefore, it is recommended that future studies specify the theoretical underpinnings of the research as well as the BCTs employed to target theory-driven, behavioural determinants. It is worth noting that the process of coding BCTs was, to an extent, limited by the brief intervention descriptions and the lack of detail provided in the included studies. BCTs were coded based on what was explicitly described in intervention descriptions, and while double screening was applied to the BCT data

extraction, the full range of BCTs utilised may not have been captured in all studies. It is, therefore, a scientific priority for research papers to provide more transparent and comprehensive descriptions of the BCTs used.

Evidence from the present thesis provides some insights about the potential intervention characteristics that could influence intervention effectiveness in increasing CRC screening for different population subgroups. It appears that a range of strategies could be beneficial for improving screening participation among more vulnerable groups. For instance, findings from Studies 1 and 2 indicated that low SES populations benefitted more from interventions delivered by clinically-trained health professionals (e.g., GPs) compared to lay health educators, but results also showed that interventions delivered in community settings - which are traditionally delivered by non-clinically trained health professionals - were more effective than interventions delivered within the realms of primary care. Moreover, findings from Study 2 suggested that BAME populations found it beneficial to talk about CRC screening within a lay network indicating that health information exchange may promote co-learning among individuals with poorer health literacy. These findings indicate that there may be an interaction between the intervention provider and intervention setting – for instance, it would be useful to assess whether the delivery of interventions by GPs in community settings (rather than primary care) would be beneficial for increasing CRC screening uptake. Nonetheless, interventions that include components that involve GPs (e.g., patient-provider health communication, GP endorsement in screening invite) have consistently shown to lead to higher screening participation (albeit modest increases) among socioeconomically deprived and underserved populations; a finding observed between studies and across different countries (Allgood et al., 2016; Baker et al., 2014; Shankleman et al., 2014). It is therefore, anticipated that primary care endorsement would result in increases in participation. As indicated earlier in the thesis, there was some evidence that the addition of telephone calls was useful for improving intervention effectiveness among low SES populations and therefore it is recommended that future strategies aiming to improve CRC screening uptake, incorporate a telephone component.

Similarly, evidence from a small pool of studies indicated that incorporating electronic media to communicate screening-related messages (e.g., videos, websites) increased intervention effectiveness among low SES

populations, suggesting that the integration of such approaches in health interventions have the potential to positively influence CRC screening uptake. This contradicts some previous studies that have shown that the access and use of technologies is far from equal among different SES groups and that the use and access to technologies is likely to be more rapidly adopted by individuals with higher SES (Baum, Newman, & Biedrzycki, 2012; Gonzales, Ems, & Suri, 2016). Moreover, access and use among more disadvantaged groups is more likely to be disrupted due to unstable access (Baum et al., 2012; Gonzales et al., 2016), which could create greater health inequalities. Nonetheless, in recent years, there has been an increased focus on integrating innovative health-related technologies both in healthcare services as well as public health interventions and there has been a particular interest on the internet and internet-based tools (e.g., health portals, internet sites, mobile apps) to promote healthy behaviours (Korda & Itani, 2013; Webb et al., 2010). The most appealing aspect of having internet-based health interventions is the magnitude of the audience; recent UK data suggests that 90% of households in Great Britain have internet access and internet use among adults aged 65 to 74 years has increased from 52% in 2011 to 78% in 2017 (Office of National Statistics, 2018). Moreover, UK data examining internet use by ethnicity and age group indicates that in the 55 to 74 age group Internet use is approximately 68%, 72% and 84% among Asian, Black and White population subgroups respectively (Office of National Statistics, 2017), suggesting that internet use is relatively high among older adults from all ethnic groups. Even if internet-based interventions have low completion rates, the benefits from a public health perspective could be substantial. One challenge for future research would be to determine whether such strategies improve or worsen screening inequalities and whether it is feasible for internet tools to translate e-health interventions in order to create more impactful and long-lasting health behaviour change for people from different backgrounds. A recent systematic review (Weiss et al., 2018) investigating the impact of innovative technologies on social inequalities in health, indicated that the use of such technologies is more likely to significantly and positively benefit end users from poorer social strata, if the use of such technologies is ‘nested’ within the wider health care environment rather than being predominantly individual-oriented. For example, public health campaigns and interventions targeting socioeconomically vulnerable subgroups

to increase awareness about e-health strategies or using offline materials that perhaps supplement online health information might be useful strategies for promoting e-health intervention materials without increasing inequalities.

5.3.2. Proposed Conceptual Framework for Guiding CRC Screening Research

The findings from the meta-analytic review and two empirical studies included in the thesis, suggest that a range of influencing factors exist and should be considered in relation to improving CRC screening uptake and reducing CRC screening inequalities. Influencing factors comprise *individual* determinants - including psychological (e.g., attitudes, norms) and/or behavioural (e.g., past behaviour) factors -, *sociodemographic determinants* – including factors such as SES and education as well as other socio-cultural factors (e.g., religion, values) - and *healthcare system* (e.g., medical mistrust, GP recommendation) and *socio-contextual determinants* (e.g., health campaigns, media exposure). The results of studies this thesis support the movement of screening inequalities research away from a narrow focus on either sociodemographic factors or psychosocial variables and supports the notion of an integrated, comprehensive, conceptual model of the influences on CRC screening. Therefore, it is anticipated that only through the integrated understanding of the connections between sociodemographic and psychosocial determinants of CRC screening, and the integration of psychosocial determinants of CRC screening themselves, that CRC screening inequalities can be effectively addressed through evidence-based intervention research. Based on the findings from the thesis, Figure 5.1 outlines a proposal for a conceptual framework, which could be useful for guiding future research in which the relationships between factors can be empirically tested.

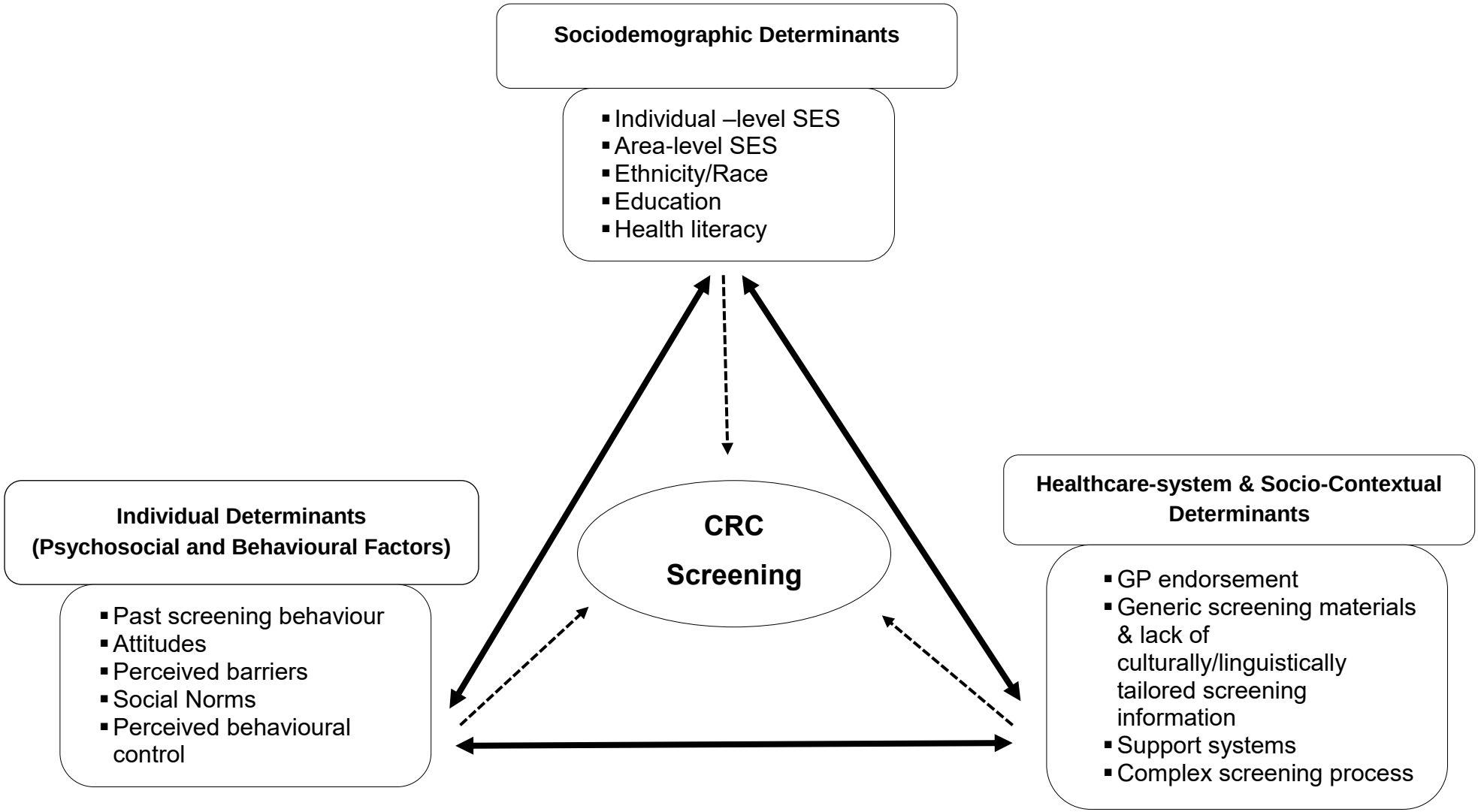


Figure 5. 1. Conceptual framework for CRC screening uptake based on thesis findings

The conceptual framework (Figure 5.1) has potential to shift our understanding of CRC screening behaviour. However, for this to be achieved robust empirical support for all of its components is needed in order to inform future policies in cancer screening and have impact in reducing CRC screening inequalities. Important considerations for future research include:

1) Whose screening behaviour are you seeking to improve?
2) Which sociodemographic/psychosocial/contextual factors need to be taken into account?
3) Which sociodemographic/psychosocial/contextual factors directly and/or indirectly affect screening intention and/or behaviour?
4) Can these factors be tackled/modified?
5) Is it feasible to personalise interventions to the needs of specific population subgroups?

5.4. Thesis Strengths and Limitations

The strengths and limitations of each study were discussed following the presentation of studies in each appropriate chapter (i.e., Chapter 2, 3 and 4). This section is concerned with outlining the overall strengths and weaknesses of the thesis.

The first strength of the present thesis, was the consideration of sociodemographic factors alongside psychosocial factors in relation to CRC screening. Although previous research has extensively examined the importance of sociodemographic determinants of CRC screening uptake, and there is growing recognition about the importance of psychological variables such as attitudes and beliefs, these factors have often been examined separately and the current literature offers few recommendations with regards to the strategies that will be successful for improving uptake for different population subgroups. Researchers have acknowledged the need to develop a robust evidence base for effective interventions for diverse populations in the UK (Kobayashi et al., 2014; Moss et al., 2012; Solmi et al., 2015; Von Wagner, Baio, et al., 2011) as well as the need to invest extra efforts in reducing inequalities in cancer screening uptake. It is to this recognised need within the wider field of cancer screening inequalities that this thesis contributes by focusing on the *interaction* between key sociodemographic factors, such as socioeconomic deprivation, ethnicity and education, and key psychosocial factors, identified through SCMs.

A second strength of the thesis is its structure; all three studies presented in the thesis approached the topic of CRC screening inequalities and the factors that affect screening participation in a systematic manner and from different angles. Firstly, Study 1 helped identify whether intervention effectiveness varied as a function of contact type, mode of delivery, intervention provider, intervention materials, intervention setting, screening modality, BCTs and extent of reported use of theory and provided clear recommendations for the types of interventions that could lead to substantial improvements in screening uptake among socioeconomically disadvantaged populations. Overall, Study 1 laid the foundations for gaining an overview of the empirical research currently available with regards to the effectiveness of interventions in different SES groups. Study 2 allowed the exploration of a range of sociodemographic and psychosocial factors affecting gFOBT screening behaviour. In Study 3, the integrated TRA/TPB and HBM were used as the basis to quantitatively examine whether key determinants identified in Study 2 were predictors of gFOBT screening intention. The inclusion of a meta-analysis, qualitative and quantitative component have enabled the development of a preliminary conceptual framework (Figure 5.1.) to help increase current understanding of CRC screening participation in different population subgroups and lay a foundation for future hypotheses with clinical and research implications.

A limitation of the thesis is that it used the IMD area-level of deprivation as the main measure of SES for Studies 2 and 3. Although the IMD is considered to be a good measure of overall deprivation through the collection of data on the socioeconomic circumstances of people that live in a particular area, there are criticisms for its use as a measure of SES. Criticisms mainly concern the fact that it cannot directly measure whether areas are improving in terms of deprivation against the average because each area's score will shift as a function of scores changing in other areas. Therefore, this interdependence of IMD scores makes it challenging to decipher whether any change in IMD score reflects true change in area-level deprivation or whether it reflects changes in the scores of other areas, which in turn makes it difficult to understand how local area are changing across time (Campbell, 2010). Moreover, the fact that it measures deprivation on an area level rather than on an individual level, implies that in areas with a high IMD score there will still be people who are socioeconomically deprived and vice versa. This can be problematic if

conclusions about associations between SES and health outcomes made at one level of the analysis (e.g., area) are extrapolated to another level (e.g., individual). Nonetheless, the IMD is considered an accurate measure for the broader concept of 'multiple deprivation', and represents a key dataset that has been used by government programmes, both at a national and local level, to identify areas that are in greater need for service commissioning and resources in order to help tackle deprivation (Payne, 2012). In addition, utilisation of the IMD was considered as not being subject to biases related to self-report, as opposed to asking participants to disclose their income, for which the risk of social desirability effects would be higher.

Another potential limitation is that the thesis did not explore the important role of health literacy in relation to CRC screening behaviour. Throughout the course of the research it became increasingly apparent that the link between health literacy and screening behaviour should be further investigated. Studies have shown that inadequate health literacy is associated with lower CRC screening uptake and that this relationship may be mediated by reductions in knowledge and overall less positive attitudes towards CRC screening. Acculturation was another factor not specifically measured in the thesis, though research suggests it may be an important factor for consideration when studying health behaviours among BAME populations. Acculturation may be measured indirectly with variables such as language fluency and years of residence in the UK, which were not variables included in any of the thesis studies. It should be noted that both health literacy and acculturation are considered challenging variables to measure (Birman & Simon, 2014; Nutbeam, 2008), nonetheless it would have been useful to examine any associations between CRC screening related variables and healthy literacy and acculturation. A final limitation of the thesis, is that thesis studies did not use translated research materials and/or translators in order to examine determinants of CRC screening among BAME populations.

5.5. Concluding Comment

CRC remains a concerning public health problem despite the fact that a substantial number of new CRC cases can be prevented through participation in screening and early diagnosis. Persistent screening inequalities in the UK and worldwide by race and SES have highlighted the need for a renewed research focus of identifying the interventions that will be effective in reducing

inequalities in CRC screening. Findings from the thesis indicated the need for targeted interventions for socioeconomically disadvantaged groups and it is anticipated that in doing so CRC screening uptake rates will increase more rapidly than the rest of the population and therefore progress will be made in eliminating CRC screening disparities. Overall, this thesis was an important hypothesis-generating body of research and contributed to the identification of both psychosocial and sociodemographic determinants specific to gFOBT screening. The findings presented in Study 3 regarding the associations between intention and race/ethnicity, SES and education were partly consistent with previous research. However, these findings should be interpreted with caution due to small proportions of BAME populations and the greater proportions of higher SES participants in the sample. Nonetheless, the thesis presented various avenues for future research including the development of interventions that target attitudes, perceived barriers and injunctive norms. In addition, thesis results suggested that consideration should be given to specific BCTs, which could all be targeted points for future intervention research and have capacity to strengthen the screening-related intention-behaviour association. The thesis has also provided a recommendation of a conceptual framework based on thesis findings mapping the links between individual, sociodemographic and contextual determinants of CRC screening uptake. Although there is much more to be learned about maximising the impact of interventions to reduce observed gaps in CRC screening, the present thesis provides substantial evidence and provides some clear directions for future research that could prove promising for reducing the socioeconomic gradient in gFOBT screening uptake in the UK.

References

Aarts, M. J., Lemmens, V. E., Louwman, M. W., Kunst, A. E., & Coebergh, J. W. W. (2010). Socioeconomic status and changing inequalities in colorectal cancer? A review of the associations with risk, treatment and outcome. *European Journal of Cancer, 46*(15), 2681-2695.

Abotchie, P. N., & Shokar, N. K. (2009). Cervical cancer screening among college students in Ghana: knowledge and health beliefs. *International journal of gynecological cancer: official journal of the International Gynecological Cancer Society, 19*(3), 412.

Abraham, C., & Michie, S. (2008). A taxonomy of behavior change techniques used in interventions. *Health Psychology, 27*(3), 379.

Abraham, C., & Sheeran, P. (2003). Implications of goal theories for the theories of reasoned action and planned behaviour. *Current Psychology, 22*(3), 264-280.

Adams, L. B., Richmond, J., Corbie-Smith, G., & Powell, W. (2017). Medical mistrust and colorectal cancer screening among African Americans. *Journal of community health, 42*(5), 1044-1061.

Adler, A., Geiger, S., Keil, A., Bias, H., Schatz, P., Dhein, J., . . . Wiedenmann, B. (2014). Improving compliance to colorectal cancer screening using blood and stool based tests in patients refusing screening colonoscopy in Germany. *BMC gastroenterology, 14*(1), 183.

Adler, N. E., & Stewart, J. (2010). Health disparities across the lifespan: meaning, methods, and mechanisms. *Annals of the New York Academy of Sciences, 1186*(1), 5-23.

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*: Sage.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes, 50*(2), 179-211.

Ajzen, I. (2002a). Construction of a standard questionnaire for the theory of planned behavior. http: www-unix. oit. umass. eduaizen. *Accessed September*.

Ajzen, I. (2002b). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32*(4), 665-683.

Ajzen, I., & Driver, B. L. (1991). Prediction of leisure participation from behavioral, normative, and control beliefs: An application of the theory of planned behavior. *Leisure sciences, 13*(3), 185-204.

Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behaviour.

Ajzen, I., & Madden, T. (1986). Prediction of goal-directed behavior from attitudinal and normative variables. *Journal of Experimental Social Psychology, 22*, 453-474.

Akkoca, A. N., Yanık, S., Özdemir, Z. T., Cihan, F. G., Sayar, S., Cincin, T. G., . . . Özer, C. (2014). TNM and Modified Dukes staging along with the demographic characteristics of patients with colorectal carcinoma. *International journal of clinical and experimental medicine, 7*(9), 2828.

Albano, J. D., Ward, E., Jemal, A., Anderson, R., Cokkinides, V. E., Murray, T., . . . Thun, M. J. (2007). Cancer mortality in the United States by education level and race. *Journal of the National Cancer Institute, 99*(18), 1384-1394.

Allgood, P. C., Maxwell, A. J., Hudson, S., Offman, J., Hutchison, G., Beattie, C., . . . Bellis, L. (2016). A randomised trial of the effect of postal reminders on attendance for breast screening. *British journal of cancer, 114*(2), 171.

Alston, C., Paget, L., Halvorson, G., Novelli, B., Guest, J., McCabe, P., . . . Sutton, S. (2012). *Communicating with patients on health care evidence*: Institute of Medicine of the National Academies.

Altobelli, E., Lattanzi, A., Paduano, R., Varassi, G., & Di Orio, F. (2014). Colorectal cancer prevention in Europe: burden of disease and status of screening programs. *Preventive medicine, 62*, 132-141.

Amireault, S., Godin, G., Vohl, M.-C., & Pérusse, L. (2008). Moderators of the intention-behaviour and perceived behavioural control-behaviour relationships for leisure-time physical activity. *International Journal of Behavioral Nutrition and Physical Activity, 5*(1), 7.

Ananda, S., Kosmider, S., Tran, B., Field, K., Jones, I., Skinner, I., . . . Gibbs, P. (2016). The rapidly escalating cost of treating colorectal cancer in Australia. *Asia-Pacific Journal of Clinical Oncology, 12*(1), 33-40.

Ananthakrishnan, A. N., Schellhase, K. G., Sparapani, R. A., Laud, P. W., & Neuner, J. M. (2007). Disparities in colon cancer screening in the Medicare population. *Archives of Internal Medicine, 167*(3), 258-264.

Anderson-Bill, E. S., Winett, R. A., & Wojcik, J. R. (2011). Social cognitive determinants of nutrition and physical activity among web-health users enrolling in an online intervention: The influence of social support, self efficacy, outcomes expectations, and self-regulation. *Journal of medical Internet research*.

Anderson, E. S., Winett, R. A., & Wojcik, J. R. (2007). Self-regulation, self-efficacy, outcome expectations, and social support: social cognitive theory and nutrition behavior. *Annals of behavioral medicine, 34*(3), 304-312.

André, T., Boni, C., Navarro, M., Tabernero, J., Hickish, T., Topham, C., . . . Rivera, F. (2009). Improved overall survival with oxaliplatin, fluorouracil, and leucovorin as adjuvant treatment in stage II or III colon cancer in the MOSAIC trial. *Journal of Clinical Oncology, 27*(19), 3109-3116.

Aragones, A., Schwartz, M. D., Shah, N. R., & Gany, F. M. (2010). A randomized controlled trial of a multilevel intervention to increase colorectal cancer screening among Latino immigrants in a primary care facility. *Journal of general internal medicine, 25*(6), 564-567.

Arai, S., Nakaya, N., Kakizaki, M., Ohmori-Matsuda, K., Shimazu, T., Kuriyama, S., . . . Tsuji, I. (2009). Personality and gastric cancer screening attendance: a cross-sectional analysis from the Miyagi Cohort Study. *Journal of epidemiology, 19*(1), 34-40.

Arcaya, M. C., Arcaya, A. L., & Subramanian, S. (2015). Inequalities in health: definitions, concepts, and theories. *Global health action, 8*(1), 27106.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British journal of social psychology, 40*(4), 471-499.

Arnold, C. N., Goel, A., Blum, H. E., & Richard Boland, C. (2005). Molecular pathogenesis of colorectal cancer. *Cancer, 104*(10), 2035-2047.

Arnold, M., Sierra, M. S., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2016). Global patterns and trends in colorectal cancer incidence and mortality. *Gut*. doi: 10.1136/gutjnl-2015-310912

Asaria, M., Ali, S., Doran, T., Ferguson, B., Fleetcroft, R., Goddard, M., . . . Cookson, R. (2016). How a universal health system reduces inequalities: lessons from England. *J Epidemiol Community Health, 70*(7), 637-643.

Atkin, W. S., Edwards, R., Kralj-Hans, I., Wooldrage, K., Hart, A. R., Northover, J. M., . . . Cuzick, J. (2010). Once-only flexible sigmoidoscopy screening in prevention of colorectal cancer: a multicentre randomised controlled trial. *The Lancet, 375*(9726), 1624-1633.

Atkinson, T. M., Salz, T., Touza, K. K., Li, Y., & Hay, J. L. (2015). Does colorectal cancer risk perception predict screening behavior? A systematic review and meta-analysis. *Journal of Behavioral Medicine, 38*(6), 837-850.

Aune, D., Chan, D. S., Lau, R., Vieira, R., Greenwood, D. C., Kampman, E., & Norat, T. (2011). Dietary fibre, whole grains, and risk of colorectal cancer: systematic review and dose-response meta-analysis of prospective studies. *Bmj, 343*, d6617.

Austin, L. T., Ahmad, F., McNally, M.-J., & Stewart, D. E. (2002). Breast and cervical cancer screening in Hispanic women: a literature review using the health belief model. *Women's Health Issues, 12*(3), 122-128.

Avery, L., Flynn, D., Van Wersch, A., Sniehotta, F. F., & Trenell, M. I. (2012). Changing physical activity behavior in type 2 diabetes: a systematic review and meta-analysis of behavioral interventions. *Diabetes care, 35*(12), 2681-2689.

Ayo, N. (2012). Understanding health promotion in a neoliberal climate and the making of health conscious citizens. *Critical public health, 22*(1), 99-105.

Ayotte, B. J., Margrett, J. A., & Hicks-Patrick, J. (2010). Physical activity in middle-aged and young-old adults: the roles of self-efficacy, barriers, outcome expectancies, self-regulatory behaviors and social support. *Journal of health psychology, 15*(2), 173-185.

Azaiza, F., & Cohen, M. (2008a). Between traditional and modern perceptions of breast and cervical cancer screenings: a qualitative study of Arab women in Israel. *Psycho-Oncology, 17*(1), 34-41.

Azaiza, F., & Cohen, M. (2008b). Colorectal cancer screening, intentions, and predictors in Jewish and Arab Israelis: a population-based study. *Health Education & Behavior, 35*(4), 478-493.

Babones, S. J. (2008). Income inequality and population health: correlation and causality. *Social science & medicine, 66*(7), 1614-1626.

Bagozzi, R. P. (1981). Attitudes, intentions, and behavior: A test of some key hypotheses. *Journal of personality and social psychology, 41*(4), 607.

Bagozzi, R. P., Wong, N., Abe, S., & Bergami, M. (2000). Cultural and situational contingencies and the theory of reasoned action: Application to fast food restaurant consumption. *Journal of Consumer Psychology, 9*(2), 97-106.

Baker, D. W., Brown, T., Buchanan, D. R., Weil, J., Balsley, K., Ranalli, L., . . . Stephens, Q. (2014). Comparative effectiveness of a multifaceted intervention to improve adherence to annual colorectal cancer screening in community health centers: a randomized clinical trial. *JAMA internal medicine, 174*(8), 1235-1241.

Bambra, C., Gibson, M., Amanda, S., Wright, K., Whitehead, M., & Petticrew, M. (2009). Tackling the wider social determinants of health and health inequalities: evidence from systematic reviews. *Journal of Epidemiology & Community Health*, jech. 2008.082743.

Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychology and Health, 13*(4), 623-649.

Banegas, M. P., Guy Jr, G. P., de Moor, J. S., Ekwueme, D. U., Virgo, K. S., Kent, E. E., . . . Yabroff, K. R. (2016). For working-age cancer survivors, medical debt and bankruptcy create financial hardships. *Health affairs, 35*(1), 54-61.

Baron, R. C., Rimer, B. K., Breslow, R. A., Coates, R. J., Kerner, J., Melillo, S., . . . Wilson, K. M. (2008). Client-directed interventions to increase community demand for breast, cervical, and colorectal cancer screening: a systematic review. *American journal of preventive medicine, 35*(1), S34-S55.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology, 51*(6), 1173.

Barthe, J., Perrodeau, E., Gilberg, S., Ravaud, P., Ghasarossian, C., Marchand-Buttin, F., . . . Falcoff, H. (2015). Impact of a doctor's invitation on participation in colorectal cancer screening: a cluster randomized trial. *The American journal of medicine, 128*(9), 1024. e1021-1024. e1027.

Bartley, M., Sacker, A., & Clarke, P. (2004). Employment status, employment conditions, and limiting illness: prospective evidence from the British household panel survey 1991–2001. *Journal of Epidemiology & Community Health, 58*(6), 501-506.

Basch, C. E., Wolf, R. L., Brouse, C. H., Shmukler, C., Neugut, A., DeCarlo, L. T., & Shea, S. (2006). Telephone outreach to increase colorectal cancer screening in an urban minority population. *American journal of public health, 96*(12), 2246-2253.

Baum, F., Newman, L., & Biedrzycki, K. (2012). Vicious cycles: digital technologies and determinants of health in Australia. *Health promotion international, 29*(2), 349-360.

Baum, F. E. (2016). Health systems: how much difference can they make to health inequities? : BMJ Publishing Group Ltd.

Baumann, L. J., Brown, R., Fontana, S. A., & Cameron, L. (1993). Testing a model of mammography intention. *Journal of Applied Social Psychology, 23*(21), 1733-1756.

Beall, R. F., Baskerville, N., Golfam, M., Saeed, S., & Little, J. (2014). Modes of delivery in preventive intervention studies: a rapid review. *European journal of clinical investigation, 44*(7), 688-696.

Becker, M. H. (1974). The health belief model and sick role behavior. *Health education monographs, 2*(4), 409-419.

Beeker, C., Kraft, J. M., Southwell, B. G., & Jorgensen, C. M. (2000). Colorectal cancer screening in older men and women: qualitative research findings and implications for intervention. *Journal of community health, 25*(3), 263-278.

Belone, L., Lucero, J. E., Duran, B., Tafoya, G., Baker, E. A., Chan, D., . . . Wallerstein, N. (2016). Community-based participatory research conceptual model: Community partner consultation and face validity. *Qualitative health research, 26*(1), 117-135.

Ben, Q., Sun, Y., Chai, R., Qian, A., Xu, B., & Yuan, Y. (2014). Dietary fiber intake reduces risk for colorectal adenoma: a meta-analysis. *Gastroenterology, 146*(3), 689-699. e686.

Benson, V. S., Patnick, J., Davies, A. K., Nadel, M. R., Smith, R. A., & Atkin, W. S. (2008). Colorectal cancer screening: a comparison of 35 initiatives in 17 countries. *International journal of cancer, 122*(6), 1357-1367.

Bergamo, C., Lin, J. J., Smith, C., Lurslurchachai, L., Halm, E. A., Powell, C. A., . . . Leventhal, H. (2013). Evaluating beliefs associated with late-stage lung cancer presentation in minorities. *Journal of Thoracic Oncology, 8*(1), 12-18.

Berkowitz, Z., Hawkins, N. A., Peipins, L. A., White, M. C., & Nadel, M. R. (2008). Beliefs, risk perceptions, and gaps in knowledge as barriers to colorectal cancer screening in older adults. *Journal of the American Geriatrics Society, 56*(2), 307-314.

Bernard, H. R., Wutich, A., & Ryan, G. W. (2016). *Analyzing qualitative data: Systematic approaches*: SAGE publications.

Beydoun, H. A., & Beydoun, M. A. (2008). Predictors of colorectal cancer screening behaviors among average-risk older adults in the United States. *Cancer Causes & Control, 19*(4), 339-359.

Birman, D., & Simon, C. D. (2014). Acculturation research: Challenges, complexities, and possibilities. *APA handbook of multicultural psychology, 1*, 207-230.

Bíró, A. (2013). Discount rates and the education gradient in mammography in the UK. *Health economics, 22*(9), 1021-1036.

Bjelakovic, G., Nikolova, D., Simonetti, R. G., & Gluud, C. (2004). Antioxidant supplements for prevention of gastrointestinal cancers: a systematic review and meta-analysis. *The Lancet, 364*(9441), 1219-1228.

Blanks, R., Benson, V., Alison, R., Brown, A., Reeves, G., Beral, V., . . . Green, J. (2015). Nationwide bowel cancer screening programme in England: cohort study of lifestyle factors affecting participation and outcomes in women. *British journal of cancer, 112*(9), 1562.

Bluethmann, S. M., Bartholomew, L. K., Murphy, C. C., & Vernon, S. W. (2017). Use of theory in behavior change interventions: an analysis of programs to increase physical activity in posttreatment breast cancer survivors. *Health Education & Behavior, 44*(2), 245-253.

Blumenthal, D. S., Smith, S. A., Majett, C. D., & Alema-Mensah, E. (2010). A trial of 3 interventions to promote colorectal cancer screening in African Americans. *Cancer, 116*(4), 922-929.

Boerma, T., Eozenou, P., Evans, D., Evans, T., Kieny, M.-P., & Wagstaff, A. (2014). Monitoring progress towards universal health coverage at country and global levels. *PLoS medicine, 11*(9), e1001731.

Bogaert, J., & Prenen, H. (2014). Molecular genetics of colorectal cancer. *Annals of gastroenterology, 27*(1), 9.

Boguradzka, A., Wiszniewski, M., Kaminski, M. F., Kraszewska, E., Mazurczak-Pluta, T., Rzewuska, D., . . . Regula, J. (2014). The effect of primary care physician counseling on participation rate and use of sedation in colonoscopy-based colorectal cancer screening program–a randomized controlled study. *Scandinavian journal of gastroenterology, 49*(7), 878-884.

Bonevski, B., Randell, M., Paul, C., Chapman, K., Twyman, L., Bryant, J., . . . Hughes, C. (2014). Reaching the hard-to-reach: a systematic review of strategies for improving health and medical research with socially disadvantaged groups. *BMC medical research methodology, 14*(1), 42.

Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. R. (2009). *References*: Wiley Online Library.

Boring, C., & Squires, T. Health CW Jr (1992) Cancer statistics for African Americans. *CA Cancer J Clin, 42*(1), 7-17.

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*: sage.

Boyle, P., & Langman, J. (2000). Epidemiology. *Bmj, 321*(7264), 805-808.

Braboy Jackson, P., & Saunders, T. (2006). Work stress, coping resources, and mental health: A study of America's black elite *Employee health, coping and methodologies* (pp. 139-169): Emerald Group Publishing Limited.

Brannon, E. E., Kuhl, E. S., Boles, R. E., Aylward, B. S., Benoit Ratcliff, M., Valenzuela, J. M., . . . Powers, S. W. (2013). Strategies for recruitment and retention of families from low-income, ethnic minority backgrounds in a longitudinal study of caregiver feeding and child weight. *Children's Health Care, 42*(3), 198-213.

Braun, K. L., Fong, M., Kaanoi, M. E., Kamaka, M. L., & Gotay, C. C. (2005). Testing a culturally appropriate, theory-based intervention to improve colorectal cancer screening among Native Hawaiians. *Preventive medicine, 40*(6), 619-627.

Braun, K. L., Thomas, W. L., Domingo, J. L. B., Allison, A. L., Ponce, A., Haunani Kamakana, P., . . . Tsark, J. U. (2015). Reducing cancer screening disparities in medicare beneficiaries through cancer patient navigation. *Journal of the American Geriatrics Society, 63*(2), 365-370.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), 77-101.

Breen, N., Lewis, D. R., Gibson, J. T., Yu, M., & Harper, S. (2017). Assessing disparities in colorectal cancer mortality by socioeconomic status using new tools: health disparities calculator and socioeconomic quintiles. *Cancer Causes & Control, 28*(2), 117-125.

Brenner, H., Hoffmeister, M., Stegmaier, C., Brenner, G., Altenhofen, L., & Haug, U. (2007). Risk of progression of advanced adenomas to colorectal cancer by age and sex: estimates based on 840 149 screening colonoscopies. *Gut, 56*(11), 1585-1589.

Brenner, H., Kloor, M., & Pox, C. P. (2014). Colorectal cancer. *The Lancet, 383*(9927), 1490-1502.

Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., McCaul, K. D., & Weinstein, N. D. (2007). Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination. *Health Psychology, 26*(2), 136.

Bridou, M., Aguerre, C., Gimenes, G., Kubiszewski, V., Le Gall, A., Potard, C., . . . Reveillere, C. (2013). Psychological barriers and facilitators of colorectal cancer screening: a French qualitative study. *Health psychology research, 1*(2).

Brouse, C. H., Basch, C. E., Wolf, R. L., Shmukler, C., Neugut, A. I., & Shea, S. (2003). Barriers to colorectal cancer screening with fecal occult blood testing in a predominantly minority urban population: a qualitative study. *American journal of public health, 93*(8), 1268-1271.

Browne, J., & Chan, A. Y. (2012). Using the Theory of Planned Behaviour and implementation intentions to predict and facilitate upward family communication about mammography. *Psychology & health, 27*(6), 655-673.

Burt, R. W., Barthel, J. S., Dunn, K. B., David, D. S., Drelichman, E., Ford, J. M., . . . Hamilton, S. R. (2010). Colorectal cancer screening. *Journal of the National Comprehensive Cancer Network, 8*(1), 8-61.

Butte, J. M., Gönen, M., Allen, P. J., Kingham, T. P., Sofocleous, C. T., DeMatteo, R. P., . . . D'Angelica, M. I. (2015). Recurrence after partial

hepatectomy for metastatic colorectal cancer: potentially curative role of salvage repeat resection. *Annals of surgical oncology, 22*(8), 2761-2771.

Bynum, S. A., Davis, J. L., Green, B. L., & Katz, R. V. (2012). Unwillingness to participate in colorectal cancer screening: examining fears, attitudes, and medical mistrust in an ethnically diverse sample of adults 50 years and older. *American journal of health promotion, 26*(5), 295-300.

Campbell, F. (2010). *The social determinants of health and the role of local government*: I & DeA Improvement and Development Agency.

Cappelletti, E. R., Kreuter, M. W., Boyum, S., & Thompson, T. (2015). Basic needs, stress and the effects of tailored health communication in vulnerable populations. *Health education research, 30*(4), 591-598.

Carman, K. L., Dardess, P., Maurer, M., Sofaer, S., Adams, K., Bechtel, C., & Sweeney, J. (2013). Patient and family engagement: a framework for understanding the elements and developing interventions and policies. *Health affairs, 32*(2), 223-231.

Carr-Hill, R. A., Chalmers-Dixon, P., Lin, J., & Britain, G. (2005). *The public health observatory handbook of health inequalities measurement*: South East Public Health Observatory Oxford.

Carrozzi, G., Sampaolo, L., Bolognesi, L., Sardonini, L., Bertozzi, N., & Giorgi Rossi, P. (2015). Cancer screening uptake: association with individual characteristics, geographic distribution, and time trends in Italy. *Epidemiol Prev, 39*(Suppl 1), 9-18.

Center, M. M., Jemal, A., & Ward, E. (2009). International trends in colorectal cancer incidence rates. *Cancer Epidemiology and Prevention Biomarkers, 18*(6), 1688-1694.

Chambers, J. A., Callander, A. S., Grangeret, R., & O'Carroll, R. E. (2016). Attitudes towards the Faecal Occult Blood Test (FOBT) versus the Faecal Immunochemical Test (FIT) for colorectal cancer screening: perceived ease of completion and disgust. *BMC cancer, 16*(1), 96.

Champion, V., Foster, J., & Menon, U. (1997). Tailoring interventions for health behavior change in breast cancer screening. *Cancer Practice, 5*(5), 283-288.

Champion, V. L. (1984). Instrument development for health belief model constructs. *Advances in Nursing Science*.

Chang, S., Long, S. R., Kutikova, L., Bowman, L., Finley, D., Crown, W. H., & Bennett, C. L. (2004). Estimating the cost of cancer: results on the basis of claims data analyses for cancer patients diagnosed with seven types of cancer during 1999 to 2000. *Journal of Clinical Oncology, 22*(17), 3524-3530.

Chapple, A., Ziebland, S., Hewitson, P., & McPherson, A. (2008). What affects the uptake of screening for bowel cancer using a faecal occult blood test (FOBt): a qualitative study. *Social science & medicine, 66*(12), 2425-2435.

Charonis, A., Kyriopoulos, I.-I., Spanakis, M., Zavras, D., Athanasakis, K., Pavi, E., & Kyriopoulos, J. (2017). Subjective social status, social network and health disparities: empirical evidence from Greece. *International journal for equity in health, 16*(1), 40.

Chen, E., Martin, A. D., & Matthews, K. A. (2006). Understanding health disparities: The role of race and socioeconomic status in children's health. *American journal of public health, 96*(4), 702-708.

Christie, J., Itzkowitz, S., Lihau-Nkanza, I., Castillo, A., Redd, W., & Jandorf, L. (2008). A randomized controlled trial using patient navigation to increase

colonoscopy screening among low-income minorities. *Journal of the National Medical Association, 100*(3), 278-284.

Christophersen, T., & Konradt, U. (2011). Reliability, validity, and sensitivity of a single-item measure of online store usability. *International Journal of Human-Computer Studies, 69*(4), 269-280.

Church, T. R., Yeazel, M. W., Jones, R. M., Kochevar, L. K., Watt, G. D., Mongin, S. J., . . . Engelhard, D. (2004). A randomized trial of direct mailing of fecal occult blood tests to increase colorectal cancer screening. *Journal of the National Cancer Institute, 96*(10), 770-780.

Clarke, N., Gallagher, P., Kearney, P. M., McNamara, D., & Sharp, L. (2016). Impact of gender on decisions to participate in faecal immunochemical test-based colorectal cancer screening: a qualitative study. *Psycho-Oncology, 25*(12), 1456-1462.

Clarke, N., McNamara, D., Kearney, P. M., O'Morain, C. A., Shearer, N., & Sharp, L. (2016). The role of area-level deprivation and gender in participation in population-based faecal immunochemical test (FIT) colorectal cancer screening. *Preventive medicine, 93*, 198-203.

Clarke, V., & Braun, V. (2014). Thematic analysis *Encyclopedia of critical psychology* (pp. 1947-1952): Springer.

Clouston, K., Katz, A., Martens, P. J., Sisler, J., Turner, D., Lobchuk, M., . . . Crow, G. (2014). Does access to a colorectal cancer screening website and/or a nurse-managed telephone help line provided to patients by their family physician increase fecal occult blood test uptake?: results from a pragmatic cluster randomized controlled trial. *BMC cancer, 14*(1), 263.

Cohen, J. (1977). Statistical power analysis for the behavioral sciences (Rev. ed.). Hillsdale, NJ, US.

Colditz, G. A., Miller, J. N., & Mosteller, F. (1989). How study design affects outcomes in comparisons of therapy. I: Medical. *Statistics in medicine, 8*(4), 441-454.

Cole, S., Smith, A., Wilson, C., Turnbull, D., Esterman, A., & Young, G. (2007). An advance notification letter increases participation in colorectal cancer screening. *Journal of medical screening, 14*(2), 73-75.

Cole, S., Young, G., Byrne, D., Guy, J., & Morcom, J. (2002). Participation in screening for colorectal cancer based on a faecal occult blood test is improved by endorsement by the primary care practitioner. *Journal of medical screening, 9*(4), 147-152.

Coleman, M. P., Babb, P., Sloggett, A., Quinn, M., & De Stavola, B. (2001). Socioeconomic inequalities in cancer survival in England and Wales. *Cancer, 91*(S1), 208-216.

Collins, M., Shattell, M., & Thomas, S. P. (2005). Problematic interviewee behaviors in qualitative research. *Western Journal of Nursing Research, 27*(2), 188-199.

Conn, V. S., Ruppar, T. M., Phillips, L. J., & Chase, J.-A. D. (2012). Using meta-analyses for comparative effectiveness research. *Nursing outlook, 60*(4), 182-190.

Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further research. *Journal of Applied Social Psychology, 28*(15), 1429-1464.

Conner, M., & Norman, P. (2015). Predicting and changing health behavior: Research and practice with social cognition models: Maidenhead, UK: McGraw Hill.

Consedine, N., Reynolds, L. & Borg, C. (2017). Emotions, delay, and avoidance in cancer screening: Roles for fear, embarrassment and disgust. In R. E. D. M. Williams, Rhodes & M. T. Conner (Eds.), *Affective determinants of health-related behaviour* (1 ed.).

Consedine, N. S., Ladwig, I., Reddig, M. K., & Broadbent, E. A. (2011). The many faeces of colorectal cancer screening embarrassment: Preliminary psychometric development and links to screening outcome. *British journal of health psychology, 16*(3), 559-579.

Cook, W. L., & Kenny, D. A. (2005). The actor–partner interdependence model: A model of bidirectional effects in developmental studies. *International Journal of Behavioral Development, 29*(2), 101-109.

Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2016). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health psychology review, 10*(2), 148-167.

Cooke, R., & French, D. P. (2008). How well do the theory of reasoned action and theory of planned behaviour predict intentions and attendance at screening programmes? A meta-analysis. *Psychology and Health, 23*(7), 745-765.

Coronado, G. D., Golovaty, I., Longton, G., Levy, L., & Jimenez, R. (2011). Effectiveness of a clinic-based colorectal cancer screening promotion program for underserved Hispanics. *Cancer, 117*(8), 1745-1754.

Costa Jr, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences, 13*(6), 653-665.

Couët, N., Desroches, S., Robitaille, H., Vaillancourt, H., Leblanc, A., Turcotte, S., . . . Légaré, F. (2015). Assessments of the extent to which health-care providers involve patients in decision making: a systematic review of studies using the OPTION instrument. *Health Expectations, 18*(4), 542-561.

Counsell, C. E., Clarke, M. J., Slattery, J., & Sandercock, P. (1994). The miracle of DICE therapy for acute stroke: fact or fictional product of subgroup analysis? *BMJ: British Medical Journal, 309*(6970), 1677.

Cradock, K. A., ÓLaighin, G., Finucane, F. M., Gainforth, H. L., Quinlan, L. R., & Ginis, K. A. M. (2017). Behaviour change techniques targeting both diet and physical activity in type 2 diabetes: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1), 18.

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *Bmj, 337*, a1655.

Crimmins, E. M., Kim, J. K., Alley, D. E., Karlamangla, A., & Seeman, T. (2007). Hispanic paradox in biological risk profiles. *American journal of public health, 97*(7), 1305-1310.

Crites Jr, S. L., Fabrigar, L. R., & Petty, R. E. (1994). Measuring the affective and cognitive properties of attitudes: Conceptual and methodological issues. *Personality and Social Psychology Bulletin, 20*(6), 619-634.

Cullati, S., Charvet-Bérard, A. I., & Perneger, T. V. (2009). Cancer screening in a middle-aged general population: factors associated with practices and attitudes. *BMC Public Health*, *9*(1), 118. https://doi.org/10.1186/1471-2458-9-118

Cutrona, S. L., Choudhry, N. K., Fischer, M. A., Servi, A., Liberman, J. N., Brennan, T., & Shrank, W. H. (2010). Modes of delivery for interventions

to improve cardiovascular medication adherence. *The American journal of managed care, 16*(12), 929.

Dalton, S. O., Schüz, J., Engholm, G., Johansen, C., Kjær, S. K., Steding-Jessen, M., . . . Olsen, J. H. (2008). Social inequality in incidence of and survival from cancer in a population-based study in Denmark, 1994–2003: summary of findings. *European Journal of Cancer, 44*(14), 2074-2085.

De Maio, F. G., Linetzky, B., Ferrante, D., & Fleischer, N. L. (2012). Extending the income inequality hypothesis: Ecological results from the 2005 and 2009 Argentine National Risk Factor Surveys. *Global public health, 7*(6), 635-647.

De Vogli, R., Mistry, R., Gnesotto, R., & Cornia, G. A. (2005). Has the relation between income inequality and life expectancy disappeared? Evidence from Italy and top industrialised countries. *Journal of Epidemiology & Community Health, 59*(2), 158-162.

de Wit, L., Fenenga, C., Giammarchi, C., di Furia, L., Hutter, I., de Winter, A., & Meijering, L. (2018). Community-based initiatives improving critical health literacy: a systematic review and meta-synthesis of qualitative evidence. *BMC Public Health, 18*(1), 40.

Decker, K. M., Demers, A. A., Nugent, Z., Biswanger, N., & Singh, H. (2015). Longitudinal rates of colon cancer screening use in Winnipeg, Canada: the experience of a universal health-care system with an organized colon screening program. *The American journal of gastroenterology, 110*(12), 1640.

DeNavas-Walt, C. (2010). *Income, poverty, and health insurance coverage in the United States (2005)*: Diane Publishing.

Denberg, T. D., Melhado, T. V., Coombes, J. M., Beaty, B. L., Berman, K., Byers, T. E., . . . Ahnen, D. J. (2005). Predictors of nonadherence to screening colonoscopy. *Journal of general internal medicine, 20*(11), 989-995.

Denlinger, C. S., & Barsevick, A. M. (2009). The challenges of colorectal cancer survivorship. *Journal of the National Comprehensive Cancer Network, 7*(8), 883-894.

Department of Work and Pensions. (2016). *Labour market status by ethnic group (England, Scotland and Wales)*

Deutekom, M., Van Rijn, A., Dekker, E., Blaauwgeers, H., Stronks, K., Fockens, P., & Essink-Bot, M.-L. (2009). Uptake of faecal occult blood test colorectal cancer screening by different ethnic groups in the Netherlands. *The European Journal of Public Health, 19*(4), 400-402.

Dharni, N., Armstrong, D., Chung-Faye, G., & Wright, A. J. (2017). Factors influencing participation in colorectal cancer screening—a qualitative study in an ethnic and socio-economically diverse inner city population. *Health Expectations, 20*(4), 608-617.

Diamantopoulos, A., & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of marketing research, 38*(2), 269-277.

DiClemente, C. C., & Prochaska, J. O. (1998). Toward a comprehensive, transtheoretical model of change: Stages of change and addictive behaviors.

Dietrich, A. J., Tobin, J. N., Cassells, A., Robinson, C. M., Greene, M. A., Sox, C. H., . . . Younge, R. G. (2006). Telephone Care Management To Improve Cancer Screening among Low-Income WomenA Randomized,

Controlled TrialImproved Cancer Screening for Low-Income Women. *Annals of internal medicine, 144*(8), 563-571.

Dietrich, A. J., Tobin, J. N., Cassells, A., Robinson, C. M., Reh, M., Romero, K. A., . . . Beach, M. L. (2007). Translation of an efficacious cancer-screening intervention to women enrolled in a Medicaid managed care organization. *The Annals of Family Medicine, 5*(4), 320-327.

Dietrich, A. J., Tobin, J. N., Robinson, C. M., Cassells, A., Greene, M. A., Dunn, V. H., . . . Beach, M. L. (2013). Telephone outreach to increase colon cancer screening in medicaid managed care organizations: a randomized controlled trial. *The Annals of Family Medicine, 11*(4), 335-343.

Dignan, M., Shelton, B., Slone, S. A., Tolle, C., Mohammad, S., Schoenberg, N., . . . Ely, G. (2014). Effectiveness of a primary care practice intervention for increasing colorectal cancer screening in Appalachian Kentucky. *Preventive medicine, 58*, 70-74.

DiLorenzo, T. A., Schnur, J., Montgomery, G. H., Erblich, J., Winkel, G., & Bovbjerg, D. H. (2006). A model of disease-specific worry in heritable disease: the influence of family history, perceived risk and worry about other illnesses. *Journal of Behavioral Medicine, 29*(1), 37-49.

Dimitroff, R., Schmidt, L., & Bond, T. (2005). Organizational behavior and disaster. *Project Management Journal, 36*(1), 28-38.

Do, D. P., Frank, R., & Finch, B. K. (2012). Does SES explain more of the black/white health gap than we thought? Revisiting our approach toward understanding racial disparities in health. *Social science & medicine, 74*(9), 1385-1393.

Documet, P., Bear, T. M., Flatt, J. D., Macia, L., Trauth, J., & Ricci, E. M. (2015). The association of social support and education with breast and cervical cancer screening. *Health Education & Behavior, 42*(1), 55-64.

Dolan, N. C., Ferreira, M. R., Davis, T. C., Fitzgibbon, M. L., Rademaker, A., Liu, D., . . . Bennett, C. L. (2004). Colorectal cancer screening knowledge, attitudes, and beliefs among veterans: does literacy make a difference? *Journal of Clinical Oncology, 22*(13), 2617-2622.

Dormandy, E., Hankins, M., & Marteau, T. M. (2006). Attitudes and uptake of a screening test: The moderating role of ambivalence. *Psychology & Health*, *21*(4), 499–511. https://doi.org/10.1080/14768320500380956

Doubeni, C. A., Laiyemo, A. O., Major, J. M., Schootman, M., Lian, M., Park, Y., . . . Sinha, R. (2012). Socioeconomic status and the risk of colorectal cancer. *Cancer, 118*(14), 3636-3644.

Douma, L. N., Uiters, E., & Timmermans, D. R. M. (n.d.). The Dutch public are positive about the colorectal cancer-screening programme, but is this a well-informed opinion? https://doi.org/10.1186/s12889-016-3870-7

Dressler, W. W., Oths, K. S., & Gravlee, C. C. (2005). Race and ethnicity in public health research: models to explain health disparities. *Annual Review of Anthropology, 34*.

Drew, P. (2006). Misalignments in" after-hours" calls to a British GP's practice: a study in telephone medicine. *STUDIES IN INTERACTIONAL SOCIOLINGUISTICS, 20*, 416.

Dubé, C. (2012). Tackling colorectal cancer as a public health issue: what can the gastroenterologist do? *Canadian Journal of Gastroenterology and Hepatology, 26*(7), 417-418.

Dusenbury, L., Brannigan, R., Falco, M., & Hansen, W. B. (2003). A review of research on fidelity of implementation: implications for drug abuse prevention in school settings. *Health education research, 18*(2), 237-256.

Duval, S. (2005). The trim and fill method. *Publication bias in meta-analysis: Prevention, assessment, and adjustments*, 127-144.

Duval, S., & Tweedie, R. (2000a). A nonparametric “trim and fill” method of accounting for publication bias in meta-analysis. *Journal of the American Statistical Association, 95*(449), 89-98.

Duval, S., & Tweedie, R. (2000b). Trim and fill: a simple funnel-plot–based method of testing and adjusting for publication bias in meta-analysis. *Biometrics, 56*(2), 455-463.

Edwards, B. K., Ward, E., Kohler, B. A., Eheman, C., Zauber, A. G., Anderson, R. N., . . . Seeff, L. C. (2010). Annual report to the nation on the status of cancer, 1975-2006, featuring colorectal cancer trends and impact of interventions (risk factors, screening, and treatment) to reduce future rates. *Cancer, 116*(3), 544-573.

Egan, M., Tannahill, C., Petticrew, M., & Thomas, S. (2008). Psychosocial risk factors in home and community settings and their associations with population health and health inequalities: a systematic meta-review. *BMC Public Health, 8*(1), 239.

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *Bmj, 315*(7109), 629-634.

Ekberg, M., Callender, M., Hamer, H., & Rogers, S. (2014). Exploring the decision to participate in the national health service bowel cancer screening programme. *European Journal of Cancer Prevention, 23*(5), 391-397.

El-Sayed, A. M., Finkton Jr, D. W., Paczkowski, M., Keyes, K. M., & Galea, S. (2015). Socioeconomic position, health behaviors, and racial disparities in cause-specific infant mortality in Michigan, USA. *Preventive medicine, 76*, 8-13.

Elmunzer, B. J., Hayward, R. A., Schoenfeld, P. S., Saini, S. D., Deshpande, A., & Waljee, A. K. (2012). Effect of flexible sigmoidoscopy-based screening on incidence and mortality of colorectal cancer: a systematic review and meta-analysis of randomized controlled trials. *PLoS medicine, 9*(12), e1001352.

Elstad, J. I., & Krokstad, S. (2003). Social causation, health-selective mobility, and the reproduction of socioeconomic health inequalities over time: panel study of adult men. *Social science & medicine, 57*(8), 1475-1489.

Emerson, E., & Hatton, C. (2007). Socioeconomic disadvantage, social participation and networks and the self-rated health of English men and women with mild and moderate intellectual disabilities: Cross sectional survey. *European Journal of Public Health, 18*(1), 31-37.

Espey, D. K., Wu, X. C., Swan, J., Wiggins, C., Jim, M. A., Ward, E., . . . Miller, B. A. (2007). Annual report to the nation on the status of cancer, 1975–2004, featuring cancer in American Indians and Alaska Natives. *Cancer, 110*(10), 2119-2152.

Evans, D. (2003). Hierarchy of evidence: a framework for ranking evidence evaluating healthcare interventions. *Journal of clinical nursing, 12*(1), 77-84.

Everett, T., Bryant, A., Griffin, M. F., Martin-Hirsch, P. P., Forbes, C. A., & Jepson, R. G. (2011). Interventions targeted at women to encourage the uptake of cervical screening. *The Cochrane Library*.

Facione, N. C., Miaskowski, C., Dodd, M. J., & Paul, S. M. (2002). The self-reported likelihood of patient delay in breast cancer: new thoughts for early detection. *Preventive medicine, 34*(4), 397-407.

Faggiano, F., Partanen, T., Kogevinas, M., & Boffetta, P. (1997). Socioeconomic differences in cancer incidence and mortality. *IARC Scientific Publications*(138), 65-176.

Faivre, J., Dancourt, V., Denis, B., Dorval, E., Piette, C., Perrin, P., . . . Levillain, R. (2012). Comparison between a guaiac and three immunochemical faecal occult blood tests in screening for colorectal cancer. *European Journal of Cancer, 48*(16), 2969-2976.

Farhadifar, F., Molina, Y., Taymoori, P., & Akhavan, S. (2016). Mediators of repeat mammography in two tailored interventions for Iranian women. *BMC Public Health, 16*(1), 149.

Fassinger, R. F., & Morrow, S. L. (2013). Toward Best Practices in Quantitative, Qualitative, and Mixed-Method Research: A Social Justice Perspective. *Journal for Social Action in Counseling and Psychology*, *5*(2).

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–91.

Fazio, R. H., Powell, M. C., & Williams, C. J. (1989). The role of attitude accessibility in the attitude-to-behavior process. *Journal of consumer research, 16*(3), 280-288.

Feng, Q., Liang, S., Jia, H., Stadlmayr, A., Tang, L., Lan, Z., . . . Jie, Z. (2015). Gut microbiome development along the colorectal adenoma–carcinoma sequence. *Nature communications, 6*, 6528.

Ferlay, J., Soerjomataram, I., Dikshit, R., Eser, S., Mathers, C., Rebelo, M., . . . Bray, F. (2015). Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *International journal of cancer, 136*(5).

Ferreira, M. R., Dolan, N. C., Fitzgibbon, M. L., Davis, T. C., Gorby, N., Ladewski, L., . . . Schmitt, B. P. (2005). Health care provider-directed intervention to increase colorectal cancer screening among veterans: results of a randomized controlled trial. *Journal of Clinical Oncology, 23*(7), 1548-1554.

Ferrer, R. A., & Klein, W. M. (2015). Risk perceptions and health behavior. *Current opinion in psychology, 5*, 85-89.

Ferroni, E., Camilloni, L., Jimenez, B., Furnari, G., Borgia, P., Guasticchi, G., . . . Group, M. t. i. p. W. (2012). How to increase uptake in oncologic screening: a systematic review of studies comparing population-based screening programs and spontaneous access. *Preventive medicine, 55*(6), 587-596.

Fiscella, K., Humiston, S., Hendren, S., Winters, P., Idris, A., Li, S. X., . . . Marcus, S. (2011). A multimodal intervention to promote mammography and colorectal cancer screening in a safety-net practice. *Journal of the National Medical Association, 103*(8), 762-768.

Fishbein, M., & Ajzen, I. (2011). *Predicting and changing behavior: The reasoned action approach*: Taylor & Francis.

Fitzgibbon, M. L., Ferreira, M. R., Dolan, N. C., Davis, T. C., Rademaker, A. W., Wolf, M. S., . . . Bennett, C. L. (2007). Process evaluation in an

intervention designed to improve rates of colorectal cancer screening in a VA medical center. *Health promotion practice, 8*(3), 273-281.

Forbes, L., Simon, A., Warburton, F., Boniface, D., Brain, K. E., Dessaix, A., . . . Lagerlund, M. (2013). Differences in cancer awareness and beliefs between Australia, Canada, Denmark, Norway, Sweden and the UK (the International Cancer Benchmarking Partnership): do they contribute to differences in cancer survival? *British journal of cancer, 108*(2), 292.

Ford, M. E., Havstad, S., Vernon, S. W., Davis, S. D., Kroll, D., Lamerato, L., & Swanson, G. M. (2006). Enhancing adherence among older African American men enrolled in a longitudinal cancer screening trial. *The Gerontologist, 46*(4), 545-550.

Ford, M. E., Tilley, B. C., & McDonald, P. E. (1998). Social support among African-American adults with diabetes. Part 1: Theoretical framework. *Journal of the National Medical Association, 90*(6), 361.

Fortuna, R. J., Idris, A., Winters, P., Humiston, S. G., Scofield, S., Hendren, S., . . . Fiscella, K. (2014). Get screened: a randomized trial of the incremental benefits of reminders, recall, and outreach on cancer screening. *Journal of general internal medicine, 29*(1), 90-97.

Foster, C., Richards, J., Thorogood, M., & Hillsdon, M. (2013). Remote and web 2.0 interventions for promoting physical activity. *Cochrane Database Syst Rev, 9*(9).

Franks, P., Muennig, P., Lubetkin, E., & Jia, H. (2006). The burden of disease associated with being African-American in the United States and the contribution of socio-economic status. *Social science & medicine, 62*(10), 2469-2478.

Frazzetto, P., Vacante, M., Malaguarnera, M., Vinci, E., Catalano, F., Cataudella, E., . . . Biondi, A. (2012). Depression in older breast cancer survivors. *BMC surgery, 12*(1), S14.

Frederiksen, B., Jørgensen, T., Brasso, K., Holten, I., & Osler, M. (2010). Socioeconomic position and participation in colorectal cancer screening. *British journal of cancer, 103*(10), 1496.

Frederiksen, B., Osler, M., Harling, H., & Jørgensen, T. (2008). Social inequalities in stage at diagnosis of rectal but not in colonic cancer: a nationwide study. *British journal of cancer, 98*(3), 668.

Freeman, H. P., & Rodriguez, R. L. (2011). History and principles of patient navigation. *Cancer, 117*(S15), 3537-3540.

Freimuth, V. S., & Mettger, W. (1990). Is there a hard-to-reach audience? *Public health reports, 105*(3), 232.

Frenk, J. (2015). Leading the way towards universal health coverage: a call to action. *The Lancet, 385*(9975), 1352-1358.

Friedemann-Sánchez, G., Griffin, J. M., & Partin, M. R. (2007). Gender differences in colorectal cancer screening barriers and information needs. *Health Expectations, 10*(2), 148-160.

Friis, S., Riis, A. H., Erichsen, R., Baron, J. A., & Sørensen, H. T. (2015). Low-dose aspirin or nonsteroidal anti-inflammatory drug use and colorectal cancer risk: a population-based, case–control study. *Annals of internal medicine, 163*(5), 347-355.

Gale, C. R., Deary, I. J., Wardle, J., Zaninotto, P., & Batty, G. D. (2015). Cognitive ability and personality as predictors of participation in a national colorectal cancer screening programme: the English Longitudinal Study of Ageing. *J Epidemiol Community Health, 69*(6), 530-535.

Ganz, P. A., Farmer, M. M., Belman, M. J., Garcia, C. A., Streja, L., Dietrich, A. J., . . . Kahn, K. L. (2005). Results of a randomized controlled trial to increase colorectal cancer screening in a managed care health plan. *Cancer, 104*(10), 2072-2083.

Gellad, Z. F., & Provenzale, D. (2010). Colorectal cancer: national and international perspective on the burden of disease and public health impact. *Gastroenterology, 138*(6), 2177-2190.

Gimeno-García, A., Quintero, E., Nicolás-Pérez, D., & Jiménez-Sosa, A. (2011). Public awareness of colorectal cancer and screening in a Spanish population. *Public Health, 125*(9), 609-615.

Gimeno-García, A. Z., Quintero, E., Nicolás-Pérez, D., Parra-Blanco, A., & Jiménez-Sosa, A. (2009). Impact of an educational video-based strategy on the behavior process associated with colorectal cancer screening: a randomized controlled study. *Cancer Epidemiology, 33*(3), 216-222.

Gimeno Garcia, A. Z. (2012). Factors influencing colorectal cancer screening participation. *Gastroenterology Research and Practice, 2012*.

Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annual review of public health, 31*, 399-418.

Godin, G., & Kok, G. (1996). The theory of planned behavior: a review of its applications to health-related behaviors. *American journal of health promotion, 11*(2), 87-98.

Goede, S. L., Rabeneck, L., Van Ballegooijen, M., Zauber, A. G., Paszat, L. F., Hoch, J. S., . . . Lansdorp-Vogelaar, I. (2017). Harms, benefits and costs of fecal immunochemical testing versus guaiac fecal occult blood testing for colorectal cancer screening. *PloS one, 12*(3), e0172864.

Goldberg, D., Schiff, G. D., McNutt, R., Furumoto-Dawson, A., Hammerman, M., & Hoffman, A. (2004). Mailings timed to patients' appointments: a controlled trial of fecal occult blood test cards. *American journal of preventive medicine, 26*(5), 431-435.

Goldman, N. (1994). Social factors and health: the causation-selection issue revisited. *Proceedings of the National Academy of Sciences, 91*(4), 1251-1255.

Goldsmith, G., & Chiaro, C. (2008). Colorectal cancer screening: how to help patients comply. *The Journal of family practice, 57*(7), E2-7.

Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European review of social psychology, 4*(1), 141-185.

Gonzales, A. L., Ems, L., & Suri, V. R. (2016). Cell phone disconnection disrupts access to healthcare and health resources: A technology maintenance perspective. *new media & society, 18*(8), 1422-1438.

Goodman, M. J., Ogdie, A., Kanamori, M. J., Canar, J., & O Malley, A. S. (2006). Barriers and facilitators of colorectal cancer screening among Mid-Atlantic Latinos: focus group findings. *Ethnicity and Disease, 16*(1), 255.

Gorin, S. S., Ashford, A. R., Lantigua, R., Hossain, A., Desai, M., Troxel, A., & Gemson, D. (2006). Effectiveness of academic detailing on breast cancer screening among primary care physicians in an underserved community. *The Journal of the American Board of Family Medicine, 19*(2), 110-121.

Gosling, S. D., Rentfrow, P. J., & Swann Jr, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality, 37*(6), 504-528.

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., & Schwarz, P. (2011). Systematic review of reviews of

intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health, 11*(1), 119.

Green, B. B., Anderson, M. L., Chubak, J., Fuller, S., Meenan, R. T., & Vernon, S. W. (2016). Impact of continued mailed fecal tests in the patient-centered medical home: Year 3 of the Systems of Support to Increase Colon Cancer Screening and Follow-Up randomized trial. *Cancer, 122*(2), 312-321.

Green, B. B., Wang, C.-Y., Anderson, M. L., Chubak, J., Meenan, R. T., Vernon, S. W., & Fuller, S. (2013). An Automated Intervention With Stepped Increases in Support to Increase Uptake of Colorectal Cancer ScreeningA Randomized Trial. *Annals of internal medicine, 158*(5_Part_1), 301-311.

Greener, J., Douglas, F., & van Teijlingen, E. (2010). More of the same? Conflicting perspectives of obesity causation and intervention amongst overweight people, health professionals and policy makers. *Social science & medicine, 70*(7), 1042-1049.

Greiner, K. A., Born, W., Nollen, N., & Ahluwalia, J. S. (2005). Knowledge and perceptions of colorectal cancer screening among urban African Americans. *Journal of general internal medicine, 20*(11), 977-983.

Greisinger, A., Hawley, S. T., Bettencourt, J. L., Perz, C. A., & Vernon, S. W. (2006). Primary care patients' understanding of colorectal cancer screening. *Cancer detection and prevention, 30*(1), 67-74.

Grosso, G., Bella, F., Godos, J., Sciacca, S., Del Rio, D., Ray, S., . . . Giovannucci, E. L. (2017). Possible role of diet in cancer: Systematic review and multiple meta-analyses of dietary patterns, lifestyle factors, and cancer risk. *Nutrition reviews, 75*(6), 405-419.

Guiriguet, C., Muñoz-Ortiz, L., Burón, A., Rivero, I., Grau, J., Vela-Vallespín, C., . . . Méndez-Boo, L. (2016). Alerts in electronic medical records to promote colorectal cancer screening programme: a cluster randomised controlled trial in primary care. *Br J Gen Pract*, bjgpjul-2016-2066-2648-guiriguet-fl-p.

Gupta, S., Halm, E. A., Rockey, D. C., Hammons, M., Koch, M., Carter, E., . . . Kashner, M. (2013). Comparative effectiveness of fecal immunochemical test outreach, colonoscopy outreach, and usual care for boosting colorectal cancer screening among the underserved: a randomized clinical trial. *JAMA internal medicine, 173*(18), 1725-1732.

Gutiérrez-Ibarluzea, I., Asua, J., & Latorre, K. (2008). Policies of screening for colorectal cancer in European countries. *International journal of technology assessment in health care, 24*(3), 270-276.

Guy Jr, G. P., Ekwueme, D. U., Yabroff, K. R., Dowling, E. C., Li, C., Rodriguez, J. L., . . . Virgo, K. S. (2013). Economic burden of cancer survivorship among adults in the United States. *Journal of Clinical Oncology, 31*(30), 3749.

Haahr, J. P. L., Frost, P., & Andersen, J. H. (2007). Predictors of health related job loss: a two-year follow-up study in a general working population. *Journal of occupational rehabilitation, 17*(4), 581-592.

Haggar, F. A., & Boushey, R. P. (2009). Colorectal cancer epidemiology: incidence, mortality, survival, and risk factors. *Clinics in colon and rectal surgery, 22*(4), 191.

Hagger, M. S., Chatzisarantis, N., Biddle, S. J., & Orbell, S. (2001). Antecedents of children's physical activity intentions and behaviour: Predictive validity and longitudinal effects. *Psychology and Health, 16*(4), 391-407.

Hagger, M. S., Chatzisarantis, N. L., & Biddle, S. J. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *Journal of sport and exercise psychology, 24*(1), 3-32.

Hagger, M. S., Lonsdale, A., Koka, A., Hein, V., Pasi, H., Lintunen, T., & Chatzisarantis, N. L. (2012). An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *International Journal of Behavioral Medicine, 19*(1), 82-96.

Hagoel, L., Neter, E., Stein, N., & Rennert, G. (2016). Harnessing the Question–Behavior Effect to Enhance Colorectal Cancer Screening in an mHealth Experiment. *American journal of public health, 106*(11), 1998-2004.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (1998). *Multivariate data analysis* (Vol. 5): Prentice hall Upper Saddle River, NJ.

Hall, N., Birt, L., Banks, J., Emery, J., Mills, K., Johnson, M., . . . Walter, F. M. (2015). Symptom appraisal and healthcare-seeking for symptoms suggestive of colorectal cancer: a qualitative study. *BMJ open, 5*(10), e008448.

Hampson, S. E., & Friedman, H. S. (2008). Personality and health: A lifespan perspective.

Han, P. K., Moser, R. P., & Klein, W. M. (2007). Perceived ambiguity about cancer prevention recommendations: associations with cancer-related perceptions and behaviours in a US population survey. *Health Expectations, 10*(4), 321-336.

Hankonen, N., Sutton, S., Prevost, A. T., Simmons, R. K., Griffin, S. J., Kinmonth, A. L., & Hardeman, W. (2014). Which behavior change techniques are associated with changes in physical activity, diet and body mass index in people with recently diagnosed diabetes? *Annals of behavioral medicine, 49*(1), 7-17.

Hardcastle, J. D., Chamberlain, J. O., Robinson, M. H., Moss, S. M., Amar, S. S., Balfour, T. W., . . . Mangham, C. M. (1996). Randomised controlled trial of faecal-occult-blood screening for colorectal cancer. *The Lancet, 348*(9040), 1472-1477.

Harris, J., Springett, J., Booth, A., Campbell, F., Thompson, J., Goyder, E., . . . Yang, Y. (2015). Can community-based peer support promote health literacy and reduce inequalities? A realist review. *Journal of Public Health Research, 3*(3).

Harriss, D., Atkinson, G., George, K., Tim Cable, N., Reilly, T., Haboubi, N., . . . Renehan, A. G. (2009). Lifestyle factors and colorectal cancer risk (1): systematic review and meta-analysis of associations with body mass index. *Colorectal Disease, 11*(6), 547-563.

Hartling, L., Ospina, M., Liang, Y., Dryden, D. M., Hooton, N., Seida, J. K., & Klassen, T. P. (2009). Risk of bias versus quality assessment of randomised controlled trials: cross sectional study. *Bmj, 339*, b4012.

Hartmann-Boyce, J., Johns, D., Jebb, S., & Aveyard, P. (2014). Effect of behavioural techniques and delivery mode on effectiveness of weight management: systematic review, meta-analysis and meta-regression. *obesity reviews, 15*(7), 598-609.

Hatch, S. L., & Dohrenwend, B. P. (2007). Distribution of traumatic and other stressful life events by race/ethnicity, gender, SES and age: A review of the research. *American journal of community psychology, 40*(3-4), 313-332.

Hayes, A. F. (2013). Mediation, moderation, and conditional process analysis. *Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach edn. New York: Guilford Publications*, 1-20.

Hayes, N. (1997). Theory-led thematic analysis: Social identification in small companies.

Hayman, J. A., Langa, K. M., Kabeto, M. U., Katz, S. J., DeMonner, S. M., Chernew, M. E., . . . Fendrick, A. M. (2001). Estimating the cost of informal caregiving for elderly patients with cancer. *Journal of Clinical Oncology, 19*(13), 3219-3225.

Hayward, R. D., Krause, N., Ironson, G., & Pargament, K. I. (2016). Externalizing religious health beliefs and health and well-being outcomes. *Journal of Behavioral Medicine, 39*(5), 887-895.

Heckhausen, H., & Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motivation and emotion, 11*(2), 101-120.

Hemingway, H., Stafford, M., Stansfeld, S., Shipley, M., & Marmot, M. (1997). Is the SF-36 a valid measure of change in population health? Results from the Whitehall II study. *Bmj, 315*(7118), 1273-1279.

Henderson, S., Kendall, E., & See, L. (2011). The effectiveness of culturally appropriate interventions to manage or prevent chronic disease in culturally and linguistically diverse communities: a systematic literature review. *Health & social care in the community, 19*(3), 225-249.

Hendren, S., Winters, P., Humiston, S., Idris, A., Li, S. X., Ford, P., . . . Fiscella, K. (2014). Randomized, controlled trial of a multimodal intervention to improve cancer screening rates in a safety-net primary care practice. *Journal of general internal medicine, 29*(1), 41-49.

Heresbach, D., Manfredi, S., D'halluin, P. N., Bretagne, J.-F., & Branger, B. (2006). Review in depth and meta-analysis of controlled trials on colorectal cancer screening by faecal occult blood test. *European journal of gastroenterology & hepatology, 18*(4), 427-433.

Hewitson, P., Ward, A., Heneghan, C., Halloran, S., & Mant, D. (2011). Primary care endorsement letter and a patient leaflet to improve participation in colorectal cancer screening: results of a factorial randomised trial. *British journal of cancer, 105*(4), 475.

Hibbard, J. H., & Greene, J. (2013). What the evidence shows about patient activation: better health outcomes and care experiences; fewer data on costs. *Health affairs, 32*(2), 207-214.

Higgins, J. P., Altman, D. G., Gøtzsche, P. C., Jüni, P., Moher, D., Oxman, A. D., . . . Sterne, J. A. (2011). The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. *Bmj, 343*, d5928.

Higgins, J. P., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ: British Medical Journal, 327*(7414), 557.

Hill, E. M., & Gick, M. L. (2011). The big five and cervical screening barriers: Evidence for the influence of conscientiousness, extraversion and openness. *Personality and Individual Differences, 50*(5), 662-667.

Hillier-Brown, F. C., Bambra, C. L., Cairns, J.-M., Kasim, A., Moore, H. J., & Summerbell, C. D. (2014). A systematic review of the effectiveness of individual, community and societal level interventions at reducing socioeconomic inequalities in obesity amongst children. *BMC Public Health, 14*(1), 834.

Hochbaum, G. M. (1958). *Public participation in medical screening programs: A socio-psychological study*: US Department of Health, Education, and Welfare, Public Health Service, Bureau of State Services, Division of Special Health Services, Tuberculosis Program.

Hoffman-Goetz, L., Thomson, M. D., & Donelle, L. (2008). Reasons for declining colorectal cancer screening by older Canadians: a pilot study. *Journal of Cancer Education, 23*(1), 32.

Hoffmann, R., Kröger, H., & Geyer, S. (2018). Social Causation Versus Health Selection in the Life Course: Does Their Relative Importance Differ by Dimension of SES? *Social Indicators Research*, 1-27.

Hol, L., Van Leerdam, M. E., Van Ballegooijen, M., Van Vuuren, A. J., Van Dekken, H., Reijerink, J. C., . . . Kuipers, E. J. (2010). Screening for colorectal cancer: randomised trial comparing guaiac-based and immunochemical faecal occult blood testing and flexible sigmoidoscopy. *Gut, 59*(01), 62-68.

Holden, D. J., Jonas, D. E., Porterfield, D. S., Reuland, D., & Harris, R. (2010). Systematic review: enhancing the use and quality of colorectal cancer screening. *Annals of internal medicine, 152*(10), 668-676.

Holmes, J. H., Lehman, A., Hade, E., Ferketich, A. K., Gehlert, S., Rauscher, G. H., . . . Bird, C. E. (2008). Challenges for multilevel health disparities research in a transdisciplinary environment. *American journal of preventive medicine, 35*(2), S182-S192.

Holt, C. L., Scarinci, I. C., Debnam, K., McDavid, C., Litaker, M., McNeal, S. F., . . . Crowther, M. (2012). Spiritually based intervention to increase colorectal cancer awareness among African Americans: Intermediate outcomes from a randomized trial. *Journal of health communication, 17*(9), 1028-1049.

Honein-AbouHaidar, G. N., Baxter, N. N., Moineddin, R., Urbach, D. R., Rabeneck, L., & Bierman, A. S. (2013). Trends and inequities in colorectal cancer screening participation in Ontario, Canada, 2005–2011. *Cancer Epidemiology, 37*(6), 946-956.

Honein-AbouHaidar, G. N., Kastner, M., Vuong, V., Perrier, L., Daly, C., Rabeneck, L., . . . Baxter, N. N. (2016). Systematic review and meta-study synthesis of qualitative studies evaluating facilitators and barriers to participation in colorectal cancer screening. *Cancer Epidemiology and Prevention Biomarkers, 25*(6), 907-917.

Horne, H. N., Phelan-Emrick, D. F., Pollack, C. E., Markakis, D., Wenzel, J., Ahmed, S., . . . Johnson, L. B. (2015). Effect of patient navigation on colorectal cancer screening in a community-based randomized controlled trial of urban African American adults. *Cancer Causes & Control, 26*(2), 239-246.

Howitt, D., & Cramer, D. (2010). *Introduction to qualitative methods in psychology*: Prentice hall Harlow.

Hubbard, R. A., O'Meara, E. S., Henderson, L. M., Hill, D., Braithwaite, D., Haas, J. S., . . . Tosteson, A. N. (2016). Multilevel factors associated with long-term adherence to screening mammography in older women in the US. *Preventive medicine, 89*, 169-177.

Hurtado, J. L., Bacigalupe, A., Calvo, M., Esnaola, S., Mendizabal, N., Portillo, I., . . . Arana-Arri, E. (2015). Social inequalities in a population based colorectal cancer screening programme in the Basque Country. *BMC Public Health, 15*(1), 1021.

Hwang, K. O., Ottenbacher, A. J., Graham, A. L., Thomas, E. J., Street, R. L., & Vernon, S. W. (2013). Online narratives and peer support for colorectal cancer screening: a pilot randomized trial. *American journal of preventive medicine, 45*(1), 98-107.

Inada, R., Nagasaka, T., Watanabe, A., Yagi, T., Mori, Y., Kondo, Y., . . . Fujiwara, T. (2017). Comparison of outcomes between symptomatic and asymptomatic patients with colorectal cancer: a propensity score-matched analysis of surgical invasiveness, medical costs and oncological outcomes. *BMJ open gastroenterology, 4*(1), e000146.

Inadomi, J. M., Vijan, S., Janz, N. K., Fagerlin, A., Thomas, J. P., Lin, Y. V., . . . Hayward, R. A. (2012). Adherence to colorectal cancer screening: a randomized clinical trial of competing strategies. *Archives of Internal Medicine, 172*(7), 575-582.

Israel, B. A., Coombe, C. M., Cheezum, R. R., Schulz, A. J., McGranaghan, R. J., Lichtenstein, R., . . . Burris, A. (2010). Community-based participatory research: a capacity-building approach for policy advocacy aimed at eliminating health disparities. *American journal of public health, 100*(11), 2094-2102.

Jackson-Thompson, J., Ahmed, F., German, R. R., Lai, S. M., & Friedman, C. (2006). Descriptive epidemiology of colorectal cancer in the United States, 1998–2001. *Cancer, 107*(S5), 1103-1111.

Jacobs, R. J., Lou, J. Q., Ownby, R. L., & Caballero, J. (2016). A systematic review of eHealth interventions to improve health literacy. *Health informatics journal, 22*(2), 81-98.

James, S. A., Van Hoewyk, J., Belli, R. F., Strogatz, D. S., Williams, D. R., & Raghunathan, T. E. (2006). Life-course socioeconomic position and hypertension in African American men: the Pitt County Study. *American journal of public health, 96*(5), 812-817.

Jamshed, S. (2014). Qualitative research method-interviewing and observation. *Journal of basic and clinical pharmacy, 5*(4), 87.

Jamtvedt, G., Young, J. M., Kristoffersen, D. T., O'Brien, M. A., & Oxman, A. D. (2006). Audit and feedback: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev, 2*(2).

Jandorf, L., Braschi, C., Ernstoff, E., Wong, C. R., Thelemaque, L., Winkel, G., . . . Itzkowitz, S. H. (2013). Culturally targeted patient navigation for increasing African Americans' adherence to screening colonoscopy: a randomized clinical trial. *Cancer Epidemiology and Prevention Biomarkers, 22*(9), 1577-1587.

Janout, V., & Kollárová, H. (2001). Epidemiology of colorectal cancer. *Acta-Universitatis Palackianae Olomucensis Facultatis Medicae*, 5-10.

Janssen, E., van Osch, L., de Vries, H., & Lechner, L. (2011). Measuring risk perceptions of skin cancer: Reliability and validity of different operationalizations. *British journal of health psychology, 16*(1), 92-112.

Janz, N. K., & Becker, M. H. (1984). The health belief model: A decade later. *Health education quarterly, 11*(1), 1-47.

Javanparast, S., Ward, P., Young, G., Wilson, C., Carter, S., Misan, G., . . . Martini, A. (2010). How equitable are colorectal cancer screening programs which include FOBTs? A review of qualitative and quantitative studies. *Preventive medicine, 50*(4), 165-172.

Javanparast, S., Ward, P. R., Carter, S. M., & Wilson, C. J. (2012). Barriers to and facilitators of colorectal cancer screening in different population

subgroups in Adelaide, South Australia. *The Medical Journal of Australia, 196*(8), 521-523.

Jean-Jacques, M., Kaleba, E. O., Gatta, J. L., Gracia, G., Ryan, E. R., & Choucair, B. N. (2012). Program to improve colorectal cancer screening in a low-income, racially diverse population: a randomized controlled trial. *The Annals of Family Medicine, 10*(5), 412-417.

Jensen, J. D., King, A. J., Carcioppolo, N., Krakow, M., Samadder, N. J., & Morgan, S. (2014). Comparing tailored and narrative worksite interventions at increasing colonoscopy adherence in adults 50–75: a randomized controlled trial. *Social science & medicine, 104*, 31-40.

Jepson, R., Clegg, A., Forbes, C., Lewis, R., Sowden, A., & Kleijnen, J. (2000). The determinants of screening uptake and interventions for increasing uptake: a systematic review.

Jiang, S., & Velasquez-Garcia, H. (2017). The role of education in colorectal cancer screening participation: Updated evidence from Canadian Community Health Survey (2011–2012). *Cancer Treatment and Research Communications, 10*, 1-5.

Johnson, B. T., Carey, M. P., Chaudoir, S. R., & Reid, A. E. (2006). Sexual risk reduction for persons living with HIV: research synthesis of randomized controlled trials, 1993–2004. *Journal of acquired immune deficiency syndromes (1999), 41*(5), 642.

Johnson, C. E., Mues, K. E., Mayne, S. L., & Kiblawi, A. N. (2008). Cervical cancer screening among immigrants and ethnic minorities: a systematic review using the Health Belief Model. *Journal of lower genital tract disease, 12*(3), 232-241.

Jokela, M., Batty, G. D., Nyberg, S. T., Virtanen, M., Nabi, H., Singh-Manoux, A., & Kivimäki, M. (2013). Personality and all-cause mortality: individual-participant meta-analysis of 3,947 deaths in 76,150 adults. *American journal of epidemiology, 178*(5), 667-675.

Jonas, D. E., Russell, L. B., Sandler, R. S., Chou, J., & Pignone, M. (2008). Value of patient time invested in the colonoscopy screening process: time requirements for colonoscopy study. *Medical Decision Making, 28*(1), 56-65.

Jones, R. M., Devers, K. J., Kuzel, A. J., & Woolf, S. H. (2010). Patient-reported barriers to colorectal cancer screening: a mixed-methods analysis. *American journal of preventive medicine, 38*(5), 508-516.

Joseph, D. A., King, J. B., Miller, J. W., Richardson, L. C., Control, C. f. D., & Prevention. (2012). Prevalence of colorectal cancer screening among adults—behavioral risk factor surveillance system, United States, 2010. *MMWR Morb Mortal Wkly Rep, 61*(Suppl), 51-56.

Kähkönen, O., Kankkunen, P., Saaranen, T., Miettinen, H., Kyngäs, H., & Lamidi, M. L. (2015). Motivation is a crucial factor for adherence to a healthy lifestyle among people with coronary heart disease after percutaneous coronary intervention. *Journal of advanced nursing, 71*(10), 2364-2373.

Kahneman, D., & Tversky, A. (1981). The simulation heuristic: STANFORD UNIV CA DEPT OF PSYCHOLOGY.

Kaiser, B. L., Thomas, G. R., & Bowers, B. J. (2017). A Case Study of Engaging Hard-to-Reach Participants in the Research Process: Community Advisors on Research Design and Strategies (CARDS)®. *Research in nursing & health, 40*(1), 70-79.

Kaplan, G. A., & Keil, J. E. (1993). Socioeconomic factors and cardiovascular disease: a review of the literature. *Circulation, 88*(4), 1973-1998.

Karbani, G., Lim, J., Hewison, J., Atkin, K., Horgan, K., Lansdown, M., & Chu, C. E. (2011). Culture, attitude and knowledge about breast cancer and preventive measures: a qualitative study of South Asian breast cancer patients in the UK. *Asian Pac J Cancer Prev, 12*(6), 1619-1626.

Karlsen, S., & Nazroo, J. Y. (2002). Relation between racial discrimination, social class, and health among ethnic minority groups. *American journal of public health, 92*(4), 624-631.

Karoly, P. (1993). Mechanisms of self-regulation: A systems view. *Annual review of psychology, 44*(1), 23-52.

Katz, M. L., Fisher, J. J. L., Fleming, K., & Paskett, E. D. (2011). Patient activation increases colorectal cancer screening rates: a randomized trial among low-income minority patients. *Cancer Epidemiology and Prevention Biomarkers*, cebp. 0815.2011.

Kawachi, I., Daniels, N., & Robinson, D. E. (2005). Health disparities by race and class: why both matter. *Health affairs, 24*(2), 343-352.

Kenway, P., & Palmer, G. (2007). *Poverty among ethnic groups*: New Policy Institute and Joseph Rowntree Foundation.

Kern, M. L., & Friedman, H. S. (2008). Do conscientious individuals live longer? A quantitative review. *Health Psychology, 27*(5), 505.

Kickbusch, I. S. (2001). Health literacy: addressing the health and education divide. *Health promotion international, 16*(3), 289-297.

Kidwell, B., & Jewell, R. D. (2003). An examination of perceived behavioral control: internal and external influences on intention. *Psychology & Marketing, 20*(7), 625-642.

Kim, K., Yu, E. S., Chen, E. H., Kim, J., & Brintnall, R. A. (1998). Knowledge and practices among Korean Americans. *Cancer Practice, 6*(3), 167-175.

Kim, S. E., Pérez-Stable, E. J., Wong, S., Gregorich, S., Sawaya, G. F., Walsh, J. M., & Kaplan, C. P. (2008). Association between cancer risk perception and screening behavior among diverse women. *Archives of Internal Medicine, 168*(7), 728-734.

Klabunde, C., Cronin, K. A., Breen, N., Waldron, W. R., Ambs, A. H., & Nadel, M. (2011). Trends in colorectal cancer test use among vulnerable populations in the US. *Cancer Epidemiology and Prevention Biomarkers*, cebp. 0220.2011.

Klabunde, C. N., Meissner, H. I., Wooten, K. G., Breen, N., & Singleton, J. A. (2007). Comparing colorectal cancer screening and immunization status in older Americans. *American journal of preventive medicine, 33*(1), 1-8.

Klonoff, E. A. (2009). Disparities in the provision of medical care: an outcome in search of an explanation. *Journal of Behavioral Medicine, 32*(1), 48.

Kobayashi, L. C., Wardle, J., & von Wagner, C. (2014). Limited health literacy is a barrier to colorectal cancer screening in England: evidence from the English Longitudinal Study of Ageing. *Preventive medicine, 61*, 100-105.

Koehler, M., Yadav, A., Phillips, M., & Cavazos-Kottke, S. (2005). What is video good for? Examining how media and story genre interact. *Journal of Educational Multimedia and Hypermedia, 14*(3), 249.

Koo, J. H., Arasaratnam, M. M., Liu, K., Redmond, D. M., Connor, S. J., Sung, J. J., & Leong, R. W. (2010). Knowledge, perception and practices of colorectal cancer screening in an ethnically diverse population. *Cancer Epidemiology, 34*(5), 604-610.

Kor, K., & Mullan, B. A. (2011). Sleep hygiene behaviours: An application of the theory of planned behaviour and the investigation of perceived autonomy support, past behaviour and response inhibition. *Psychology & health, 26*(9), 1208-1224.

Korda, H., & Itani, Z. (2013). Harnessing social media for health promotion and behavior change. *Health promotion practice, 14*(1), 15-23.

Kozica, S., Lombard, C., Ilic, D., Ng, S., Harrison, C., & Teede, H. (2015). Acceptability of delivery modes for lifestyle advice in a large scale randomised controlled obesity prevention trial. *BMC Public Health, 15*(1), 699.

Kreuter, M. W., McQueen, A., Boyum, S., & Fu, Q. (2016). Unmet basic needs and health intervention effectiveness in low-income populations. *Preventive medicine, 91*, 70-75.

Kröger, H. (2017). The stratifying role of job level for sickness absence and the moderating role of gender and occupational gender composition. *Social science & medicine, 186*, 1-9.

Kröger, H., Pakpahan, E., & Hoffmann, R. (2015). What causes health inequality? A systematic review on the relative importance of social causation and health selection. *The European Journal of Public Health, 25*(6), 951-960.

Krok-Schoen, J. L., Katz, M. L., Oliveri, J. M., Young, G. S., Pennell, M. L., Reiter, P. L., . . . Tatum, C. M. (2015). A media and clinic intervention to increase colorectal cancer screening in Ohio Appalachia. *BioMed research international, 2015*.

Kronborg, O., Fenger, C., Olsen, J., Jørgensen, O. D., & Søndergaard, O. (1996). Randomised study of screening for colorectal cancer with faecal-occult-blood test. *The Lancet, 348*(9040), 1467-1471.

Kuitto, K., Pickel, S., Neumann, H., Jahn, D., & Metelmann, H.-R. (2010). Attitudinal and socio-structural determinants of cervical cancer screening and HPV vaccination uptake: a quantitative multivariate analysis. *Journal of Public Health, 18*(2), 179-188.

Kunz, R., & Oxman, A. D. (1998). The unpredictability paradox: review of empirical comparisons of randomised and non-randomised clinical trials. *Bmj, 317*(7167), 1185-1190.

Kwasnicka, D., Dombrowski, S. U., White, M., & Sniehotta, F. (2016). Theoretical explanations for maintenance of behaviour change: a systematic review of behaviour theories. *Health psychology review, 10*(3), 277-296.

Lafata, J. E., Wunderlich, T., Flocke, S. A., Oja-Tebbe, N., Dyer, K. E., & Siminoff, L. A. (2014). Physician use of persuasion and colorectal cancer screening. *Translational behavioral medicine, 5*(1), 87-93.

Lambert, S. D., Loiselle, C. G., & Macdonald, M. E. (2009). An in-depth exploration of information-seeking behavior among individuals with cancer: part 1: understanding differential patterns of active information seeking. *Cancer Nursing, 32*(1), 11-23.

Lang, K., Lines, L. M., Lee, D. W., Korn, J. R., Earle, C. C., & Menzin, J. (2009). Lifetime and treatment-phase costs associated with colorectal cancer: evidence from SEER-Medicare data. *Clinical Gastroenterology and Hepatology, 7*(2), 198-204.

Lange, F. (2011). The role of education in complex health decisions: evidence from cancer screening. *Journal of Health Economics, 30*(1), 43-54.

Lansdorp-Vogelaar, I., Kuntz, K. M., Knudsen, A. B., van Ballegooijen, M., Zauber, A. G., & Jemal, A. (2012). Contribution of screening and survival differences to racial disparities in colorectal cancer rates. *Cancer Epidemiology and Prevention Biomarkers, 21*(5), 728-736.

Lansdorp-Vogelaar, I., Van Ballegooijen, M., Zauber, A. G., Habbema, J. D. F., & Kuipers, E. J. (2009). Effect of rising chemotherapy costs on the cost savings of colorectal cancer screening. *JNCI: Journal of the National Cancer Institute, 101*(20), 1412-1422.

Lara, J., Hobbs, N., Moynihan, P. J., Meyer, T. D., Adamson, A. J., Errington, L., . . . Mathers, J. C. (2014). Effectiveness of dietary interventions among adults of retirement age: a systematic review and meta-analysis of randomized controlled trials. *BMC medicine, 12*(1), 60.

Larkin, P. J., Dierckx De Casterlé, B., & Schotsmans, P. (2007). Multilingual Translation Issues in Qualitative Research: Reflections on a Metaphorical Process, *17*.

Lau, R. R., Hartman, K. A., & Ware, J. E. (1986). Health as a value: Methodological and theoretical considerations. *Health Psychology, 5*(1), 25.

Laudicella, M., Walsh, B., Burns, E., & Smith, P. C. (2016). Cost of care for cancer patients in England: evidence from population-based patient-level data. *British journal of cancer, 114*(11), 1286.

Lauver, D., Nabholz, S., Scott, K., & Tak, Y. (1997). Testing theoretical explanations of mammography use. *Nursing Research, 46*(1), 32-39.

LaVeist, T. A. (2005). Disentangling race and socioeconomic status: a key to understanding health inequalities. *Journal of Urban Health, 82*(3), iii26-iii34.

Lee, C. S., Ronan, L., O'morain, C., McNamara, D., Ferlay, Jemal, . . . Hewitson. (2012). Screening for colorectal cancer: what fits best? *Expert review of gastroenterology & hepatology, 6*(3), 301-312.

Lee, J. K., Reis, V., Liu, S., Conn, L., Groessl, E. J., Ganiats, T. G., & Ho, S. B. (2009). Improving fecal occult blood testing compliance using a mailed educational reminder. *Journal of general internal medicine, 24*(11), 1192.

Légaré, F., Stacey, D., Turcotte, S., Cossi, M. J., Kryworuchko, J., Graham, I. D., . . . Elwyn, G. (2014). Interventions for improving the adoption of shared decision making by healthcare professionals. *The Cochrane Library*.

Légaré, F., & Witteman, H. O. (2013). Shared decision making: examining key elements and barriers to adoption into routine clinical practice. *Health affairs, 32*(2), 276-284.

Leggett, B., & Whitehall, V. (2010). Role of the serrated pathway in colorectal cancer pathogenesis. *Gastroenterology, 138*(6), 2088-2100.

Legler, J., Meissner, H. I., Coyne, C., Breen, N., Chollette, V., & Rimer, B. K. (2002). The effectiveness of interventions to promote mammography among women with historically lower rates of screening. *Cancer Epidemiology and Prevention Biomarkers, 11*(1), 59-71.

Leonidaki, V. (2015). Critical Appraisal in the Context of Integrations of Qualitative Evidence in Applied Psychology: The Introduction of a New Appraisal Tool for Interview Studies. *Qualitative Research in Psychology*, *12*(4), 435–452.

Levi, Z., Birkenfeld, S., Vilkin, A., Bar-Chana, M., Lifshitz, I., Chared, M., . . . Niv, Y. (2011). A higher detection rate for colorectal cancer and advanced adenomatous polyp for screening with immunochemical fecal occult

blood test than guaiac fecal occult blood test, despite lower compliance rate. A prospective, controlled, feasibility study. *International journal of cancer, 128*(10), 2415-2424.

Levy, B. T., Daly, J. M., Xu, Y., & Ely, J. W. (2012). Mailed fecal immunochemical tests plus educational materials to improve colon cancer screening rates in Iowa Research Network (IRENE) practices. *The Journal of the American Board of Family Medicine, 25*(1), 73-82.

Levy, B. T., Xu, Y., Daly, J. M., & Ely, J. W. (2013). A randomized controlled trial to improve colon cancer screening in rural family medicine: an Iowa Research Network (IRENE) study. *The Journal of the American Board of Family Medicine, 26*(5), 486-497.

Lewis-Beck, C., & Lewis-Beck, M. (2015). *Applied regression: An introduction* (Vol. 22): Sage publications.

Lewis, C. L., Brenner, A. T., Griffith, J. M., Moore, C. G., & Pignone, M. P. (2012). Two controlled trials to determine the effectiveness of a mailed intervention to increase colon cancer screening. *North Carolina medical journal, 73*(2), 93.

Liang, P. S., Chen, T. Y., & Giovannucci, E. (2009). Cigarette smoking and colorectal cancer incidence and mortality: Systematic review and meta-analysis. *International journal of cancer, 124*(10), 2406-2415.

Liao, C.-C., Wang, H., Lin, R., Hsieh, C.-Y., & Sung, F.-C. (2006). Addressing Taiwan's high incidence of cervical cancer: factors associated with the Nation's low compliance with Papanicolaou screening in Taiwan. *Public Health, 120*(12), 1170-1176.

Lin, J. S., Piper, M. A., Perdue, L. A., Rutter, C. M., Webber, E. M., O'Connor, E., . . . Whitlock, E. P. (2016). Screening for colorectal cancer: updated evidence report and systematic review for the US Preventive Services Task Force. *Jama, 315*(23), 2576-2594.

Lindholm, E., Brevinge, H., & Haglind, E. (2008). Survival benefit in a randomized clinical trial of faecal occult blood screening for colorectal cancer. *BJS, 95*(8), 1029-1036.

Ling, B. S., Schoen, R. E., Trauth, J. M., Wahed, A. S., Eury, T., Simak, D. M., . . . Weissfeld, J. L. (2009). Physicians encouraging colorectal screening: a randomized controlled trial of enhanced office and patient management on compliance with colorectal cancer screening. *Archives of Internal Medicine, 169*(1), 47-55.

Lippke, S., & Ziegelmann, J. P. (2008). Theory-based health behavior change: Developing, testing, and applying theories for evidence-based interventions. *Applied Psychology, 57*(4), 698-716.

Liss, D. T., & Baker, D. W. (2014). Understanding current racial/ethnic disparities in colorectal cancer screening in the United States: the contribution of socioeconomic status and access to care. *American journal of preventive medicine, 46*(3), 228-236.

Lo, S. H., Good, A., Sheeran, P., Baio, G., Rainbow, S., Vart, G., . . . Wardle, J. (2014). Preformulated implementation intentions to promote colorectal cancer screening: A cluster-randomized trial. *Health Psychology, 33*(9), 998.

Lo, S. H., Halloran, S., Snowball, J., Seaman, H., Wardle, J., & von Wagner, C. (2014). Colorectal cancer screening uptake over three biennial invitation rounds in the English bowel cancer screening programme. *Gut*, gutjnl-2013-306144.

Lo, S. H., Waller, J., Vrinten, C., Kobayashi, L., & von Wagner, C. (2015). Social cognitive mediators of sociodemographic differences in colorectal cancer screening uptake. *BioMed research international, 2015*.

Lo, S. H., Waller, J., Wardle, J., & von Wagner, C. (2013). Comparing barriers to colorectal cancer screening with barriers to breast and cervical screening: a population-based survey of screening-age women in Great Britain. *Journal of medical screening, 20*(2), 73-79.

Lobchuk, M. M., Bapuji, S. B., McClement, S. E., Sisler, J. J., Katz, A., Martens, P., . . . Clouston, K. (2012). What is the role of family in promoting faecal occult blood test screening? Exploring physician, average-risk individual, and family perceptions. *Cancer Epidemiology, 36*(3), e190-e199.

Logan, R. F., Patnick, J., Nickerson, C., Coleman, L., Rutter, M. D., & von Wagner, C. (2012). Outcomes of the Bowel Cancer Screening Programme (BCSP) in England after the first 1 million tests. *Gut, 61*(10), 1439-1446.

Lorenc, T., Petticrew, M., Welch, V., & Tugwell, P. (2013). What types of interventions generate inequalities? Evidence from systematic reviews. *J Epidemiol Community Health, 67*(2), 190-193.

Low, E., Simon, A., Waller, J., Wardle, J., & Menon, U. (2013). Experience of symptoms indicative of gynaecological cancers in UK women. *British journal of cancer, 109*(4), 882.

Lumpkins, C., Cupertino, P., Young, K., Daley, C., Yeh, H., & Greiner, K. (2013). Racial/ethnic variations in colorectal cancer screening self-efficacy, fatalism and risk perception in a safety-net clinic population: implications for tailored interventions. *Journal of community medicine & health education, 3*.

Lupton, D. (2012). *Medicine as culture: Illness, disease and the body*: Sage.

Lustria, M. L. A., Noar, S. M., Cortese, J., Van Stee, S. K., Glueckauf, R. L., & Lee, J. (2013). A meta-analysis of web-delivered tailored health behavior change interventions. *Journal of health communication, 18*(9), 1039-1069.

Lyimo, F. S., & Beran, T. N. (2012). Demographic, knowledge, attitudinal, and accessibility factors associated with uptake of cervical cancer screening among women in a rural district of Tanzania: three public policy implications. *BMC Public Health, 12*(1), 22.

Lyratzopoulos, G., Elliott, M., Barbiere, J., Henderson, A., Staetsky, L., Paddison, C., . . . Roland, M. (2012). Understanding ethnic and other socio-demographic differences in patient experience of primary care: evidence from the English General Practice Patient Survey. *BMJ Qual Saf, 21*(1), 21-29.

Lyratzopoulos, G., Liu, M. P.-H., Abel, G. A., Wardle, J., & Keating, N. L. (2015). The association between fatalistic beliefs and late stage at diagnosis of lung and colorectal cancer. *Cancer Epidemiology and Prevention Biomarkers*, cebp. 0969.2014.

Lyratzopoulos, G., Sheridan, G., Michie, H., McElduff, P., & Hobbiss, J. (2004). Absence of socioeconomic variation in survival from colorectal cancer in patients receiving surgical treatment in one health district: cohort study. *Colorectal Disease, 6*(6), 512-517.

MacDonald, J., Lorimer, K., Knussen, C., & Flowers, P. (2016). Interventions to increase condom use among middle-aged and older adults: A systematic review of theoretical bases, behaviour change techniques, modes of

delivery and treatment fidelity. *Journal of health psychology, 21*(11), 2477-2492.

Mackenbach, J. P., Stirbu, I., Roskam, A.-J. R., Schaap, M. M., Menvielle, G., Leinsalu, M., & Kunst, A. E. (2008). Socioeconomic inequalities in health in 22 European countries. *New England Journal of Medicine, 358*(23), 2468-2481.

MacKenzie, R., Chapman, S., McGeechan, K., & Holding, S. (2010). 'A disease many people still feel uncomfortable talking about': Australian television coverage of colorectal cancer. *Psycho-Oncology, 19*(3), 283-288.

Madden, T. J., Ellen, P. S., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Personality and Social Psychology Bulletin, 18*(1), 3-9.

Maher, C. A., Lewis, L. K., Ferrar, K., Marshall, S., De Bourdeaudhuij, I., & Vandelanotte, C. (2014). Are health behavior change interventions that use online social networks effective? A systematic review. *Journal of medical Internet research, 16*(2).

Manne, S., Etz, R. S., Hudson, S. V., Medina-Forrester, A., Boscarino, J. A., Bowen, D. J., & Weinberg, D. S. (2012). A qualitative analysis of couples' communication regarding colorectal cancer screening using the Interdependence Model. *Patient education and counseling, 87*(1), 18-22.

Manne, S., Kashy, D., Weinberg, D. S., Boscarino, J. A., & Bowen, D. J. (2012). Using the interdependence model to understand spousal influence on colorectal cancer screening intentions: A structural equation model. *Annals of behavioral medicine, 43*(3), 320-329.

Manstead, A. S., & Eekelen, S. A. (1998). Distinguishing between perceived behavioral control and self-efficacy in the domain of academic achievement intentions and behaviors. *Journal of Applied Social Psychology, 28*(15), 1375-1392.

Marcus, A. C., Mason, M., Wolfe, P., Rimer, B. K., Lipkus, I., Strecher, V., . . . Davis, S. W. (2005). The efficacy of tailored print materials in promoting colorectal cancer screening: results from a randomized trial involving callers to the National Cancer Institute's Cancer Information Service. *Journal of health communication, 10*(S1), 83-104.

Mariotto, A. B., Robin Yabroff, K., Shao, Y., Feuer, E. J., & Brown, M. L. (2011). Projections of the cost of cancer care in the United States: 2010–2020. *Journal of the National Cancer Institute, 103*(2), 117-128.

Marmot, M. (2005). Social determinants of health inequalities. *The Lancet, 365*(9464), 1099-1104.

Marmot, M., Friel, S., Bell, R., Houweling, T. A., Taylor, S., & Health, C. o. S. D. o. (2008). Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet, 372*(9650), 1661-1669.

Marshall, D., McGregor, E., & Currie, G. (2010). Measuring preferences for colorectal cancer screening. *The Patient: Patient-Centered Outcomes Research, 3*(2), 79-89.

Mason, T. E., & White, K. M. (2008). Applying an extended model of the theory of planned behaviour to breast self-examination. *Journal of health psychology, 13*(7), 946-955.

Matthews, A. K., Berrios, N., Darnell, J. S., & Calhoun, E. (2006). A qualitative evaluation of a faith-based breast and cervical cancer screening intervention for African American women. *Health Education & Behavior, 33*(5), 643-663.

Max, W., Rice, D. P., Sung, H.-Y., Michel, M., Breuer, W., & Zhang, X. (2003). The economic burden of gynecologic cancers in California, 1998. *Gynecologic oncology, 88*(2), 96-103.

Maxwell, A. E., Bastani, R., Danao, L. L., Antonio, C., Garcia, G. M., & Crespi, C. M. (2010). Results of a community-based randomized trial to increase colorectal cancer screening among Filipino Americans. *American journal of public health, 100*(11), 2228-2234.

Maxwell, A. E., Danao, L. L., Cayetano, R. T., Crespi, C. M., & Bastani, R. (2016). Implementation of an evidence-based intervention to promote colorectal cancer screening in community organizations: a cluster randomized trial. *Translational behavioral medicine, 6*(2), 295-305.

Maynard, D. W., & Heritage, J. (2005). Conversation analysis, doctor–patient interaction and medical communication. *Medical education, 39*(4), 428-435.

McAlearney, A. S., Reeves, K. W., Dickinson, S. L., Kelly, K. M., Tatum, C., Katz, M. L., & Paskett, E. D. (2008). Racial differences in colorectal cancer screening practices and knowledge within a low-income population. *Cancer, 112*(2), 391-398.

McCaffery, K., Wardle, J., & Waller, J. (2003). Knowledge, attitudes, and behavioral intentions in relation to the early detection of colorectal cancer in the United Kingdom. *Preventive medicine, 36*(5), 525-535.

McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health psychology review, 5*(2), 97-144.

McGill, R., Anwar, E., Orton, L., Bromley, H., Lloyd-Williams, F., O'Flaherty, M., . . . Moreira, P. (2015). Are interventions to promote healthy eating equally effective for all? Systematic review of socioeconomic inequalities in impact. *BMC Public Health, 15*(1), 457.

McGregor, von Wagner, C., Atkin, W., Kralj-Hans, I., Halloran, S., Handley, G., . . . Snowball, J. (2016). Reducing the social gradient in uptake of the NHS Colorectal Cancer Screening Programme using a narrative-based information leaflet: a cluster-randomised trial. *Gastroenterology Research and Practice, 2016*.

McGregor, S. E., Hilsden, R. J., Li, F. X., Bryant, H. E., & Murray, A. (2007). Low uptake of colorectal cancer screening 3 yr after release of national recommendations for screening. *The American journal of gastroenterology, 102*(8), 1727-1735.

McNamara, C. (2009). General guidelines for conducting interviews. Retrieved January 11, 2010.

Meester, R. G., Doubeni, C. A., Zauber, A. G., Goede, S. L., Levin, T. R., Corley, D. A., . . . Lansdorp-Vogelaar, I. (2015). Public health impact of achieving 80% colorectal cancer screening rates in the United States by 2018. *Cancer, 121*(13), 2281-2285.

Meissner, H. I., Breen, N., Klabunde, C. N., & Vernon, S. W. (2006). Patterns of colorectal cancer screening uptake among men and women in the United States. *Cancer Epidemiology and Prevention Biomarkers, 15*(2), 389-394.

Menon, U., Belue, R., Wahab, S., Rugen, K., Kinney, A. Y., Maramaldi, P., . . . Szalacha, L. A. (2011). A randomized trial comparing the effect of two phone-based interventions on colorectal cancer screening adherence. *Annals of behavioral medicine, 42*(3), 294-303.

Merzel, C., & D'Afflitti, J. (2003). Reconsidering community-based health promotion: promise, performance, and potential. *American journal of public health, 93*(4), 557-574.

Michie, S., Ashford, S., Sniehotta, F. F., Dombrowski, S. U., Bishop, A., & French, D. P. (2011). A refined taxonomy of behaviour change techniques to help people change their physical activity and healthy eating behaviours: the CALO-RE taxonomy. *Psychology & health, 26*(11), 1479-1498.

Michie, S., Dormandy, E., French, D. P., & Marteau, T. M. (2004). Using the theory of planned behaviour to predict screening uptake in two contexts. *Psychology & health, 19*(6), 705-718.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied Psychology, 57*(4), 660-680.

Michie, S., & Prestwich, A. (2010). Are interventions theory-based? Development of a theory coding scheme. *Health Psychology, 29*(1), 1.

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., . . . Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Annals of behavioral medicine, 46*(1), 81-95.

Miles, A., Rainbow, S., & von Wagner, C. (2011). Cancer fatalism and poor self-rated health mediate the association between socioeconomic status and uptake of colorectal cancer screening in England. *Cancer Epidemiology and Prevention Biomarkers, 20*(10), 2132-2140.

Miles, J., & Shevlin, M. (2001). *Applying regression and correlation: A guide for students and researchers*: Sage.

Miller, D. P., Kimberly, J. R., Case, L. D., & Wofford, J. L. (2005). Using a computer to teach patients about fecal occult blood screening. *Journal of general internal medicine, 20*(11), 984-988.

Miller, K. D., Siegel, R. L., Lin, C. C., Mariotto, A. B., Kramer, J. L., Rowland, J. H., . . . Jemal, A. (2016). Cancer treatment and survivorship statistics, 2016. *CA: a cancer journal for clinicians, 66*(4), 271-289.

Miller, S. M., Brody, D. S., & Summerton, J. (1988). Styles of coping with threat: implications for health. *Journal of personality and social psychology, 54*(1), 142.

Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British journal of health psychology, 7*(2), 163-184.

Mirowsky, J. (2017). *Education, social status, and health*: Routledge.

Mirowsky, J., & Ross, C. E. (2008). Education and self-rated health: Cumulative advantage and its rising importance. *Research on Aging, 30*(1), 93-122.

Mitry, E., Rachet, B., Quinn, M., Cooper, N., & Coleman, M. (2008). Survival from cancer of the colon in England and Wales up to 2001. *British journal of cancer, 99*(S1), S26.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & Group, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS medicine, 6*(7), e1000097.

Molina-Barceló, A., Salas Trejo, D., Peiró-Pérez, R., & Málaga López, A. (2011). To participate or not? Giving voice to gender and socio-economic

differences in colorectal cancer screening programmes. *European journal of cancer care, 20*(5), 669-678.

Mols, F., Schoormans, D., de Hingh, I., Oerlemans, S., & Husson, O. (2018). Symptoms of anxiety and depression among colorectal cancer survivors from the population-based, longitudinal PROFILES Registry: Prevalence, predictors, and impact on quality of life. *Cancer*.

Montaño, D. E., Thompson, B., Taylor, V. M., & Mahloch, J. (1997). Understanding mammography intention and utilization among women in an inner city public hospital clinic. *Preventive medicine, 26*(6), 817-824.

Montgomery, K. S., & Jones Schubart, K. (2010). Health promotion in culturally diverse and vulnerable populations. *Home Health Care Management & Practice, 22*(2), 131-139.

Morgan, S. E., Harrison, T. R., Afifi, W. A., Long, S. D., & Stephenson, M. T. (2008). In their own words: the reasons why people will (not) sign an organ donor card. *Health communication, 23*(1), 23-33.

Morrison, L. G. (2015). Theory-based strategies for enhancing the impact and usage of digital health behaviour change interventions: A review. *Digital Health, 1*, 2055207615595335.

Mosen, D. M., Feldstein, A. C., Perrin, N., Rosales, A. G., Smith, D. H., Liles, E. G., . . . Kositch, M. (2010). Automated telephone calls improved completion of fecal occult blood testing. *Medical care, 48*(7), 604.

Moss, S., Campbell, C., Melia, J., Coleman, D., Smith, S., Parker, R., . . . Weller, D. (2012). Performance measures in three rounds of the English bowel cancer screening pilot. *Gut, 61*(1), 101-107.

Moss, S., Mathews, C., Day, T., Smith, S., & Halloran, S. P. (2015). A faecal immunochemical test for haemoglobin (FIT) markedly increased participation in a colorectal cancer screening pilot in England. *Women, 60*, 64.

Moss, S., Mathews, C., Day, T., Smith, S., Seaman, H. E., Snowball, J., & Halloran, S. P. (2016). Increased uptake and improved outcomes of bowel cancer screening with a faecal immunochemical test: results from a pilot study within the national screening programme in England. *Gut*, gutjnl-2015-310691.

Moyers, T. B., Miller, W. R., & Hendrickson, S. M. (2005). How does motivational interviewing work? Therapist interpersonal skill predicts client involvement within motivational interviewing sessions. *Journal of consulting and clinical psychology, 73*(4), 590.

Murphy, C. C., Harlan, L. C., Lund, J. L., Lynch, C. F., & Geiger, A. M. (2015). Patterns of colorectal cancer care in the United States: 1990–2010. *JNCI: Journal of the National Cancer Institute, 107*(10).

Musa, J., Achenbach, C. J., O'Dwyer, L. C., Evans, C. T., McHugh, M., Hou, L., . . . Jordan, N. (2017). Effect of cervical cancer education and provider recommendation for screening on screening rates: A systematic review and meta-analysis. *PloS one, 12*(9), e0183924.

Myers, R. E., Sifri, R., Hyslop, T., Rosenthal, M., Vernon, S. W., Cocroft, J., . . . Wender, R. (2007). A randomized controlled trial of the impact of targeted and tailored interventions on colorectal cancer screening. *Cancer, 110*(9), 2083-2091.

Nápoles, A. M., Gregorich, S. E., Santoyo-Olsson, J., O'brien, H., & Stewart, A. L. (2009). Interpersonal processes of care and patient satisfaction: do associations differ by race, ethnicity, and language? *Health services research, 44*(4), 1326-1344.

Nápoles, A. M., Santoyo-Olsson, J., Stewart, A. L., Olmstead, J., Gregorich, S. E., Farren, G., . . . Pérez-Stable, E. J. (2015). Physician counseling on colorectal cancer screening and receipt of screening among Latino patients. *Journal of general internal medicine, 30*(4), 483-489.

National Cancer Intelligence Network. (2009). Colorectal Cancer Survival by Stage. NCIN Data Briefing.

National Cancer Transformation Board. (2016). Achieving World Class Cancer Outcomes: Taking the Strategy Forward. .

Navarro, V. (1990). Race or class versus race and class: mortality differentials in the United States. *Lancet, 336*(8725), 1238-1240.

Nazroo, J. Y. (1997). *The health of Britain's ethnic minorities: findings from a national survey*.

Nazroo, J. Y. (2003). The structuring of ethnic inequalities in health: economic position, racial discrimination, and racism. *American journal of public health, 93*(2), 277-284.

Neter, E., Stein, N., Barnett-Griness, O., Rennert, G., & Hagoel, L. (2014). From the bench to public health: population-level implementation intentions in colorectal cancer screening. *American journal of preventive medicine, 46*(3), 273-280.

Ning, Y., Wang, L., & Giovannucci, E. (2010). A quantitative analysis of body mass index and colorectal cancer: findings from 56 observational studies. *obesity reviews, 11*(1), 19-30.

Noar, S. M., & Zimmerman, R. S. (2005). Health Behavior Theory and cumulative knowledge regarding health behaviors: are we moving in the right direction? *Health education research, 20*(3), 275-290.

Norman, P., & Cooper, Y. (2011). The theory of planned behaviour and breast self-examination: Assessing the impact of past behaviour, context stability and habit strength. *Psychology & health, 26*(9), 1156-1172.

Norman, P., & Hoyle, S. (2004). The theory of planned behavior and breast self-examination: Distinguishing between perceived control and self-efficacy. *Journal of Applied Social Psychology, 34*(4), 694-708.

Norris, S. L., Chowdhury, F. M., Van Le, K., Horsley, T., Brownstein, J. N., Zhang, X., . . . Satterfield, D. W. (2006). Effectiveness of community health workers in the care of persons with diabetes. *Diabetic Medicine, 23*(5), 544-556.

Nunnally, J. C., & Bernstein, I. (1994). Psychometric Theory (McGraw-Hill Series in Psychology): McGraw-Hill New York.

Nutbeam, D. (2000). Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health promotion international, 15*(3), 259-267.

Nutbeam, D. (2008). The evolving concept of health literacy. *Social science & medicine, 67*(12), 2072-2078.

O'Carroll, R. E., Chambers, J. A., Brownlee, L., Libby, G., & Steele, R. J. (2015). Anticipated regret to increase uptake of colorectal cancer screening (ARTICS): a randomised controlled trial. *Social science & medicine, 142*, 118-127.

O'Carroll, R. E., Foster, C., McGeechan, G., Sandford, K., & Ferguson, E. (2011). The “ick” factor, anticipated regret, and willingness to become an organ donor. *Health Psychology, 30*(2), 236.

O'Sullivan, I., & Orbell, S. (2004). Self-sampling in screening to reduce mortality from colorectal cancer: a qualitative exploration of the decision to

complete a faecal occult blood test (FOBT). *Journal of medical screening, 11*(1), 16-22.

Odedina, F. T., Dagne, G., Pressey, S., Odedina, O., Emanuel, F., Scrivens, J., . . . LaRose-Pierre, M. (2011). *Prostate cancer health and cultural beliefs of black men: The Florida Prostate Cancer Disparity Project.* Paper presented at the Infectious agents and cancer.

Odgaard-Jensen, J., Vist, G. E., Timmer, A., Kunz, R., Akl, E. A., Schünemann, H., . . . Oxman, A. D. (2011). Randomisation to protect against selection bias in healthcare trials. *The Cochrane Library*.

Office of National Statistics. (2013). Focus on Ethnicity and Identity Summary Report.

Office of National Statistics. (2017). Internet users in the UK: 2017.

Office of National Statistics. (2018). Internet users, UK: 2018.

Ogilvie, G. S., Smith, L. W., Van Niekerk, D. J., Khurshed, F., Krajden, M., Saraiya, M., . . . Hobbs, S. (2013). Women's intentions to receive cervical cancer screening with primary human papillomavirus testing. *International journal of cancer, 133*(12), 2934-2943.

Olander, E. K., Fletcher, H., Williams, S., Atkinson, L., Turner, A., & French, D. P. (2013). What are the most effective techniques in changing obese individuals' physical activity self-efficacy and behaviour: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 10*(1), 29.

Oldach, B. R., & Katz, M. L. (2014). Health literacy and cancer screening: a systematic review. *Patient education and counseling, 94*(2), 149-157.

Olson, J. M., & Zanna, M. P. (1993). Attitudes and attitude change. *Annual review of psychology, 44*(1), 117-154.

Orbell, S., Crombie, I., & Johnston, G. (1996). Social cognition and social structure in the prediction of cervical screening uptake. *British journal of health psychology, 1*(1), 35-50.

Orbell, S., Hagger, M., Brown, V., & Tidy, J. (2006). Comparing two theories of health behavior: A prospective study of noncompletion of treatment following cervical cancer screening. *Health Psychology, 25*(5), 604.

Orbell, S., Hodgldns, S., & Sheeran, P. (1997). Implementation intentions and the theory of planned behavior. *Personality and Social Psychology Bulletin, 23*(9), 945-954.

Orbell, S., Perugini, M., & Rakow, T. (2004). Individual differences in sensitivity to health communications: consideration of future consequences. *Health Psychology, 23*(4), 388.

Orbell, S., Szczepura, A., Weller, D., Gumber, A., & Hagger, M. S. (2017). South Asian ethnicity, socioeconomic status, and psychological mediators of faecal occult blood colorectal screening participation: A prospective test of a process model. *Health Psychology, 36*(12), 1161.

Organization, W. H. (2007). *Cancer control: knowledge into action: WHO guide for effective programmes* (Vol. 2): World Health Organization.

Organization, W. H. (2014). Global status report on noncommunicable diseases 2014: attaining the nine global noncommunicable diseases targets; a shared responsability *Global status report on noncommunicable diseases 2014: attaining the nine global noncommunicable diseases targets; a shared responsability*.

Ornstein, S., Nemeth, L. S., Jenkins, R. G., & Nietert, P. J. (2010). Colorectal cancer screening in primary care: translating research into practice. *Medical care, 48*(10), 900.

Oster, C., Zajac, I., Flight, I., Hart, E., Turnbull, D., Wilson, C., & Young, G. P. (2013). Ambivalence and its influence on participation and non-participation in screening for colorectal cancer.

Osterberg, L., & Blaschke, T. (2005). Adherence to medication. *New England Journal of Medicine, 353*(5), 487-497.

Ostrove, J., Adler, N., Kuppermann, M., & Washington, E. (2001). Resources and rankings: Objective and subjective assessments of socioeconomic status and their relationship to health in an ethnically diverse sample of pregnant women. *University of California, San Diego*.

Otado, J., Kwagyan, J., Edwards, D., Ukaegbu, A., Rockcliffe, F., & Osafo, N. (2015). Culturally competent strategies for recruitment and retention of African American populations into clinical trials. *Clinical and translational science, 8*(5), 460-466.

Ouellette, J. A., & Wood, W. (1998). Habit and intention in everyday life: The multiple processes by which past behavior predicts future behavior. *Psychological bulletin, 124*(1), 54.

Ouwehand, C., de Ridder, D. T., & Bensing, J. M. (2009). Who can afford to look to the future? The relationship between socio-economic status and proactive coping. *The European Journal of Public Health, 19*(4), 412-417.

Padela, A. I., Peek, M., Johnson-Agbakwu, C. E., Hosseinian, Z., & Curlin, F. (2014). Associations between religion-related factors and cervical cancer screening among Muslims in greater Chicago. *Journal of lower genital tract disease, 18*(4), 326.

Padela, A. I., Vu, M., Muhammad, H., Marfani, F., Mallick, S., Peek, M., & Quinn, M. T. (2016). Religious beliefs and mammography intention: findings from a qualitative study of a diverse group of American Muslim women. *Psycho-Oncology, 25*(10), 1175-1182.

Palmer, C., Thomas, M., Von Wagner, C., & Raine, R. (2014). Reasons for non-uptake and subsequent participation in the NHS Bowel Cancer Screening Programme: a qualitative study. *British journal of cancer, 110*(7), 1705.

Palmer, C. K., Thomas, M. C., McGregor, L. M., von Wagner, C., & Raine, R. (2015). Understanding low colorectal cancer screening uptake in South Asian faith communities in England–a qualitative study. *BMC Public Health, 15*(1), 998.

Palmer, R. C., & Schneider, E. C. (2005). Social disparities across the continuum of colorectal cancer: a systematic review. *Cancer Causes and Control, 16*(1), 55-61.

Papaioannou, D., Cooper, K., Carroll, C., Hind, D., Squires, H., Tappenden, P., & Logan, R. (2011). Antioxidants in the chemoprevention of colorectal cancer and colorectal adenomas in the general population: a systematic review and meta-analysis. *Colorectal Disease, 13*(10), 1085-1099.

Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative social work, 1*(3), 261-283.

Patton, M. Q. (2005). *Qualitative research*: Wiley Online Library.

Pei, X., & Rodriguez, E. (2006). Provincial income inequality and self-reported health status in China during 1991–7. *Journal of Epidemiology & Community Health, 60*(12), 1065-1069.

Peipins, L. A., McCarty, F., Hawkins, N. A., Rodriguez, J. L., Scholl, L. E., & Leadbetter, S. (2015). Cognitive and affective influences on perceived risk of ovarian cancer. *Psycho-Oncology, 24*(3), 279-286.

Percac-Lima, S., Grant, R. W., Green, A. R., Ashburner, J. M., Gamba, G., Oo, S., . . . Atlas, S. J. (2009). A culturally tailored navigator program for colorectal cancer screening in a community health center: a randomized, controlled trial. *Journal of general internal medicine, 24*(2), 211-217.

Perez, L., Elder, J., Haughton, J., Martinez, M., & Arredondo, E. (2017). Socio-demographic Moderators of Associations Between Psychological Factors and Latinas' Breast Cancer Screening Behaviors. *Journal of immigrant and minority health*, 1-8.

Peters, G.-J. Y., de Bruin, M., & Crutzen, R. (2015). Everything should be as simple as possible, but no simpler: towards a protocol for accumulating evidence regarding the active content of health behaviour change interventions. *Health psychology review, 9*(1), 1-14.

Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. *Advances in experimental social psychology, 19*, 123-205.

Phillips, L., Hendren, S., Humiston, S., Winters, P., & Fiscella, K. (2015). Improving breast and colon cancer screening rates: a comparison of letters, automated phone calls, or both. *The Journal of the American Board of Family Medicine, 28*(1), 46-54.

Phillips, S. M., & McAuley, E. (2013). Social cognitive influences on physical activity participation in long-term breast cancer survivors. *Psycho-Oncology, 22*(4), 783-791.

Pickett, K. E., & Wilkinson, R. G. (2015). Income inequality and health: a causal review. *Social science & medicine, 128*, 316-326.

Pignone, M., Harris, R., & Kinsinger, L. (2000). Videotape-based decision aid for colon cancer screeninga randomized, controlled trial. *Annals of internal medicine, 133*(10), 761-769.

Pignone, M., Winquist, A., Schild, L. A., Lewis, C., Scott, T., Hawley, J., . . . Glanz, K. (2011). Effectiveness of a patient and practice-level colorectal cancer screening intervention in health plan members. *Cancer, 117*(15), 3352-3362.

Portnoy, D. B., Scott-Sheldon, L. A., Johnson, B. T., & Carey, M. P. (2008). Computer-delivered interventions for health promotion and behavioral risk reduction: a meta-analysis of 75 randomized controlled trials, 1988–2007. *Preventive medicine, 47*(1), 3-16.

Potter, J., & Wetherell, M. (1987). *Discourse and social psychology: Beyond attitudes and behaviour*: Sage.

Potter, M. B., Gildengorin, G., Wang, Y., Wu, M., & Kroon, L. (2010). Comparative effectiveness of two pharmacy-based colorectal cancer screening interventions during an annual influenza vaccination campaign. *Journal of the American Pharmacists Association, 50*(2), 181-187.

Potter, M. B., Tina, M. Y., Gildengorin, G., Albert, Y. Y., Chan, K., McPhee, S. J., . . . Walsh, J. M. (2011). Adaptation of the FLU-FOBT Program for a primary care clinic serving a low-income Chinese American community: new evidence of effectiveness. *Journal of health care for the poor and underserved, 22*(1), 284-295.

Power, E., Miles, A., Von Wagner, C., Robb, K., & Wardle, J. (2009). Uptake of colorectal cancer screening: system, provider and individual factors and strategies to improve participation. *Future Oncology, 5*(9), 1371-1388.

Power, E., Van Jaarsveld, C. H., McCaffery, K., Miles, A., Atkin, W., & Wardle, J. (2008). Understanding intentions and action in colorectal cancer screening. *Annals of behavioral medicine, 35*(3), 285-294.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior research methods, 40*(3), 879-891.

Prestwich, A., Ayres, K., & Lawton, R. (2008). Crossing two types of implementation intentions with a protection motivation intervention for the reduction of saturated fat intake: A randomized trial. *Social science & medicine, 67*(10), 1550-1558.

Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour. *Psychology and Health, 18*(6), 707-721.

Prestwich, A., Sniehotta, F. F., Whittington, C., Dombrowski, S. U., Rogers, L., & Michie, S. (2014). Does theory influence the effectiveness of health behavior interventions? Meta-analysis: American Psychological Association.

Price-Haywood, E. G., Harden-Barrios, J., & Cooper, L. A. (2014). Comparative effectiveness of audit-feedback versus additional physician communication training to improve cancer screening for patients with limited health literacy. *Journal of general internal medicine, 29*(8), 1113-1121.

Public Health England. (2015). NHS Screening Programmes in England.

Rabeneck, L., Rumble, R. B., Thompson, F., Mills, M., Oleschuk, C., Whibley, A., . . . Lewis, N. (2012). Fecal immunochemical tests compared with guaiac fecal occult blood tests for population-based colorectal cancer screening. *Canadian Journal of Gastroenterology and Hepatology, 26*(3), 131-147.

Raine, R., Duffy, S. W., Wardle, J., Solmi, F., Morris, S., Howe, R., . . . Moss, S. (2016). Impact of general practice endorsement on the social gradient in uptake in bowel cancer screening. *British journal of cancer, 114*(3), 321.

Raine, R., Moss, S. M., von Wagner, C., Atkin, W., Hans, I. K., Howe, R., . . . Hackshaw, A. (2016). A national cluster-randomised controlled trial to examine the effect of enhanced reminders on the socioeconomic gradient in uptake in bowel cancer screening. *British journal of cancer, 115*(12), 1479-1486.

Rajan, K., Kennedy, J., & King, L. (2013). Is wealthier always healthier in poor countries? The health implications of income, inequality, poverty, and literacy in India. *Social science & medicine, 88*, 98-107.

Rajaram, S. S., & Rashidi, A. (1999). Asian-Islamic women and breast cancer screening: a socio-cultural analysis. *Women & health, 28*(3), 45-58.

Ramsey, S. D., Berry, K., Moinpour, C., Giedzinska, A., & Andersen, M. R. (2002). Quality of life in long term survivors of colorectal cancer. *The American journal of gastroenterology, 97*(5), 1228-1234.

Rasella, D., Aquino, R., Santos, C. A., Paes-Sousa, R., & Barreto, M. L. (2013). Effect of a conditional cash transfer programme on childhood mortality: a nationwide analysis of Brazilian municipalities. *The Lancet, 382*(9886), 57-64.

Raymond, N. C., Osman, W., O'Brien, J. M., Ali, N., Kia, F., Mohamed, F., . . . Okuyemi, K. (2014). Culturally informed views on cancer screening: a qualitative research study of the differences between older and younger Somali immigrant women. *BMC Public Health, 14*(1), 1188.

Rees, G., Martin, P., & Macrae, F. (2008). Screening participation in individuals with a family history of colorectal cancer: a review. *European journal of cancer care, 17*(3), 221-232.

Renehan, A. G., Tyson, M., Egger, M., Heller, R. F., & Zwahlen, M. (2008). Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies. *The Lancet, 371*(9612), 569-578.

Reno, R. R., Cialdini, R. B., & Kallgren, C. A. (1993). The transsituational influence of social norms. *Journal of personality and social psychology, 64*(1), 104.

Resnicow, K., Zhou, Y., Hawley, S., Jimbo, M., Ruffin, M. T., Davis, R. E., . . . Lafata, J. E. (2014). Communication preference moderates the effect of a tailored intervention to increase colorectal cancer screening among African Americans. *Patient education and counseling, 97*(3), 370-375.

Reynolds, L. M., Consedine, N. S., Pizarro, D. A., & Bissett, I. P. (2013). Disgust and behavioral avoidance in colorectal cancer screening and treatment: a systematic review and research agenda. *Cancer Nursing, 36*(2), 122-130.

Rhodes, R. E., & Courneya, K. S. (2003). Investigating multiple components of attitude, subjective norm, and perceived control: An examination of the theory of planned behaviour in the exercise domain. *British journal of social psychology, 42*(1), 129-146.

Riebl, S. K., Estabrooks, P. A., Dunsmore, J. C., Savla, J., Frisard, M. I., Dietrich, A. M., . . . Davy, B. M. (2015). A systematic literature review and meta-analysis: The Theory of Planned Behavior's application to understand and predict nutrition-related behaviors in youth. *Eating behaviors, 18*, 160-178.

Riondino, S., Roselli, M., Palmirotta, R., Della-Morte, D., Ferroni, P., & Guadagni, F. (2014). Obesity and colorectal cancer: role of adipokines in tumor initiation and progression. *World journal of gastroenterology: WJG, 20*(18), 5177.

Ritvo, P. G., Myers, R. E., Paszat, L. F., Tinmouth, J. M., McColeman, J., Mitchell, B., . . . Rabeneck, L. (2015). Personal navigation increases colorectal cancer screening uptake. *Cancer Epidemiology and Prevention Biomarkers, 24*(3), 506-511.

Robb, K. A., Power, E., Atkin, W., & Wardle, J. (2008). Ethnic differences in participation in flexible sigmoidoscopy screening in the UK. *Journal of medical screening, 15*(3), 130-136.

Robb, K. A., Solarin, I., Power, E., Atkin, W., & Wardle, J. (2008). Attitudes to colorectal cancer screening among ethnic minority groups in the UK. *BMC Public Health, 8*(1), 34.

Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological science, 2*(4), 313-345.

Rogers, C. R., Mitchell, J. A., Franta, G. J., Foster, M. J., & Shires, D. (2017). Masculinity, racism, social support, and colorectal cancer screening uptake among African American men: a systematic review. *American journal of men's health, 11*(5), 1486-1500.

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change1. *The journal of psychology, 91*(1), 93-114.

Rogers, R. W. (1983). Cognitive and psychological processes in fear appeals and attitude change: A revised theory of protection motivation. *Social psychophysiology: A sourcebook*, 153-176.

Rosenstock, I. M. (1960). What research in motivation suggests for public health. *American Journal of Public Health and the Nations Health, 50*(3_Pt_1), 295-302.

Rosenstock, I. M. (1974). Historical origins of the health belief model. *Health education monographs, 2*(4), 328-335.

Rossi, P. G., Grazzini, G., Anti, M., Baiocchi, D., Barca, A., Bellardini, P., . . . Maccallini, V. (2011). Direct mailing of faecal occult blood tests for colorectal cancer screening: a randomized population study from Central Italy. *Journal of medical screening, 18*(3), 121-127.

Rothman, A. J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: the role of message framing. *Psychological bulletin, 121*(1), 3.

Rovniak, L. S., Anderson, E. S., Winett, R. A., & Stephens, R. S. (2002). Social cognitive determinants of physical activity in young adults: a prospective structural equation analysis. *Annals of behavioral medicine, 24*(2), 149-156.

Ruder, E. H., Laiyemo, A. O., Graubard, B. I., Hollenbeck, A. R., Schatzkin, A., & Cross, A. J. (2011). Non-steroidal anti-inflammatory drugs and colorectal cancer risk in a large, prospective cohort. *The American journal of gastroenterology, 106*(7), 1340.

Ruffin, M. T., Fetters, M. D., & Jimbo, M. (2007). Preference-based electronic decision aid to promote colorectal cancer screening: results of a randomized controlled trial. *Preventive medicine, 45*(4), 267-273.

Rugkåsa, J., & Canvin, K. (2011). Researching mental health in minority ethnic communities: Reflections on recruitment. *Qualitative Health Research*, *21*(1), 132–143. https://doi.org/10.1177/1049732310379115

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist, 55*(1), 68.

Sabatino, S. A., Habarta, N., Baron, R. C., Coates, R. J., Rimer, B. K., Kerner, J., . . . Services, T. F. o. C. P. (2008). Interventions to increase recommendation and delivery of screening for breast, cervical, and colorectal cancers by healthcare providers: systematic reviews of provider assessment and feedback and provider incentives. *American journal of preventive medicine, 35*(1), S67-S74.

Saha, S., Arbelaez, J. J., & Cooper, L. A. (2003). Patient–physician relationships and racial disparities in the quality of health care. *American journal of public health, 93*(10), 1713-1719.

Salimzadeh, H., Eftekhar, H., Majdzadeh, R., Montazeri, A., & Delavari, A. (2014). Effectiveness of a theory-based intervention to increase colorectal cancer screening among Iranian health club members: a randomized trial. *Journal of Behavioral Medicine, 37*(5), 1019-1029.

Samdal, G. B., Eide, G. E., Barth, T., Williams, G., & Meland, E. (2017). Effective behaviour change techniques for physical activity and healthy eating in overweight and obese adults; systematic review and meta-regression analyses. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1), 42.

Schifter, D. E., & Ajzen, I. (1985). Intention, perceived control, and weight loss: an application of the theory of planned behavior. *Journal of personality and social psychology, 49*(3), 843.

Schnittker, J. (2004). Education and the changing shape of the income gradient in health. *Journal of Health and Social Behavior, 45*(3), 286-305.

Schoen, R. E., Pinsky, P. F., Weissfeld, J. L., Yokochi, L. A., Church, T., Laiyemo, A. O., . . . Crawford, E. D. (2012). Colorectal-cancer incidence and mortality with screening flexible sigmoidoscopy. *New England Journal of Medicine, 366*(25), 2345-2357.

Schoenberg, N. E., Eddens, K., Jonas, A., Snell-Rood, C., Studts, C. R., Broder-Oldach, B., & Katz, M. L. (2016). Colorectal cancer prevention: Perspectives of key players from social networks in a low-income rural US region. *International journal of qualitative studies on health and well-being, 11*(1), 30396.

Schreuders, E. H., Ruco, A., Rabeneck, L., Schoen, R. E., Sung, J. J., Young, G. P., & Kuipers, E. J. (2015). Colorectal cancer screening: a global overview of existing programmes. *Gut, 64*(10), 1637-1649.

Schroeder, S. A. (2016). American health improvement depends upon addressing class disparities. *Preventive medicine, 92*, 6-15.

Schroy, P. C., Glick, J. T., Robinson, P. A., Lydotes, M. A., Evans, S. R., & Emmons, K. M. (2008). Has the surge in media attention increased public awareness about colorectal cancer and screening? *Journal of community health, 33*(1), 1-9.

Schulz, K. F., Chalmers, I., Hayes, R. J., & Altman, D. G. (1995). Empirical evidence of bias: dimensions of methodological quality associated with estimates of treatment effects in controlled trials. *Jama, 273*(5), 408-412.

Schwartz, L. M., Woloshin, S., Floyd J. Fowler, J., & Welch, H. G. (2004). Enthusiasm for Cancer Screening in the United States. *JAMA*, *291*(1), 71.

Schwarzer, R., Lippke, S., & Ziegelmann, J. P. (2008). Health action process approach: A research agenda at the Freie Universität Berlin to examine and promote health behavior change. *Zeitschrift für Gesundheitspsychologie, 16*(3), 157-160.

Sekhon, M., Cartwright, M., & Francis, J. J. (2017). Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. *BMC health services research, 17*(1), 88.

Sellers, S. L., & Neighbors, H. W. (2008). Effects of goal-striving stress on the mental health of black Americans. *Journal of Health and Social Behavior, 49*(1), 92-103.

Shankleman, J., Massat, N., Khagram, L., Ariyanayagam, S., Garner, A., Khatoon, S., . . . Hu, W. (2014). Evaluation of a service intervention to improve awareness and uptake of bowel cancer screening in ethnically-diverse areas. *British journal of cancer, 111*(7), 1440.

Shavers, V. L., Fagan, P., & McDonald, P. (2007). Guest Editorial: Health Disparities Across the Cancer Continuum. *Journal of health care for the poor and underserved, 18*(6), 1-5.

Shedlin, M. G., Decena, C. U., Mangadu, T., & Martinez, A. (2011). Research participant recruitment in hispanic communities: Lessons learned. *Journal of Immigrant and Minority Health*, *13*(2), 352–360.

Sheeran, P., & Abraham, C. (2003). Mediator of moderators: Temporal stability of intention and the intention-behavior relation. *Personality and Social Psychology Bulletin, 29*(2), 205-215.

Sheeran, P., & Orbell, S. (2000). Using implementation intentions to increase attendance for cervical cancer screening. *Health Psychology, 19*(3), 283.

Sheikh, A., Halani, L., Bhopal, R., Netuveli, G., Partridge, M. R., Car, J., … Levy, M. (2009). Facilitating the Recruitment of Minority Ethnic People into Research: Qualitative Case Study of South Asians and Asthma. *PLoS Medicine*, *6*(10).

Sheldon, T. A., & Parker, H. (1992). Race and ethnicity in health research. *Journal of Public Health, 14*(2), 104-110.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of consumer research, 15*(3), 325-343.

Shi, L., Lebrun, L. A., Zhu, J., & Tsai, J. (2011). Cancer screening among racial/ethnic and insurance groups in the United States: a comparison of disparities in 2000 and 2008. *Journal of health care for the poor and underserved, 22*(3), 945-961.

Shroff, J., Thosani, N., Batra, S., Singh, H., & Guha, S. (2014). Reduced incidence and mortality from colorectal cancer with flexible-sigmoidoscopy screening: a meta-analysis. *World journal of gastroenterology: WJG, 20*(48), 18466.

Siegel, R. L., Miller, K. D., Fedewa, S. A., Ahnen, D. J., Meester, R. G., Barzi, A., & Jemal, A. (2017). Colorectal cancer statistics, 2017. *CA: a cancer journal for clinicians, 67*(3), 177-193.

Siegel, R. L., Miller, K. D., & Jemal, A. (2017). Colorectal cancer mortality rates in adults aged 20 to 54 years in the United States, 1970-2014. *Jama, 318*(6), 572-574.

Sieverding, M., Matterne, U., & Ciccarello, L. (2010). What role do social norms play in the context of men's cancer screening intention and behavior? Application of an extended theory of planned behavior. *Health Psychology, 29*(1), 72.

Silva, M. N., Marques, M. M., & Teixeira, P. J. (2014). Testing theory in practice: The example of self-determination theory-based interventions. *European Health Psychologist, 16*(5), 171-180.

Simon, S. R., Zhang, F., Soumerai, S. B., Ensroth, A., Bernstein, L., Fletcher, R. H., & Ross-Degnan, D. (2010). Failure of automated telephone outreach with speech recognition to improve colorectal cancer screening: a randomized controlled trial. *Archives of Internal Medicine, 170*(3), 264-270.

Skinner, C. S., Tiro, J., & Champion, V. L. (2015). The health belief model. *Health behavior: theory, research, and practice. 5th ed. San Francisco (US): Jossey-Bass*, 75-94.

Smith, G. D., Neaton, J. D., Wentworth, D., Stamler, R., Stamler, J., & Group, M. R. (1998). Mortality differences between black and white men in the USA: contribution of income and other risk factors among men screened for the MRFIT. *The Lancet, 351*(9107), 934-939.

Smith, S. G., Kobayashi, L. C., Wolf, M. S., Raine, R., Wardle, J., & Von Wagner, C. (2016). The associations between objective numeracy and colorectal cancer screening knowledge, attitudes and defensive processing in a deprived community sample. *Journal of health psychology, 21*(8), 1665-1675.

Smith, T., Noble, M., Noble, S., Wright, G., McLennan, D., & Plunkett, E. (2015). The English Indices of Deprivation 2015: Technical Report. London: Department for Communities and Local Government.

Solmi, F., Von Wagner, C., Kobayashi, L. C., Raine, R., Wardle, J., & Morris, S. (2015). Decomposing socio-economic inequality in colorectal cancer screening uptake in England. *Social science & medicine, 134*, 76-86.

Spencer, M. S., Rosland, A.-M., Kieffer, E. C., Sinco, B. R., Valerio, M., Palmisano, G., . . . Heisler, M. (2011). Effectiveness of a community health worker intervention among African American and Latino adults with type 2 diabetes: a randomized controlled trial. *American journal of public health, 101*(12), 2253-2260.

Squires, A. (2009). Methodological challenges in cross-language qualitative research: a research review. *International Journal of Nursing Studies*, *46*(2), 277–87.

Starfelt Sutton, L. C., & White, K. M. (2016). Predicting sun-protective intentions and behaviours using the theory of planned behaviour: a systematic review and meta-analysis. *Psychology & health, 31*(11), 1272-1292.

Steele, C. B., Rim, S. H., Joseph, D. A., King, J. B., Seeff, L. C., Control, C. f. D., & Prevention. (2013). Colorectal cancer incidence and screening-United States, 2008 and 2010. *MMWR Surveill Summ, 62*(Suppl 3), 53-60.

Steele, R., Kostourou, I., McClements, P., Watling, C., Libby, G., Weller, D., . . . Fraser, C. (2010). Effect of repeated invitations on uptake of colorectal cancer screening using faecal occult blood testing: analysis of prevalence and incidence screening. *Bmj, 341*, c5531.

Steele, R. J., McClements, P., Libby, G., Black, R., Morton, C., Birrell, J., . . . Carey, F. A. (2009). Results from the first three rounds of the Scottish demonstration pilot of FOBT screening for colorectal cancer. *Gut, 58*(4), 530-535.

Steinbrook, R. (2006). Imposing personal responsibility for health. *New England Journal of Medicine, 355*(8), 753-756.

Strom, J. L., & Egede, L. E. (2012). The impact of social support on outcomes in adult patients with type 2 diabetes: a systematic review. *Current diabetes reports, 12*(6), 769-781.

Subramanian, S., Chen, J. T., Rehkopf, D. H., Waterman, P. D., & Krieger, N. (2005). Racial disparities in context: a multilevel analysis of neighborhood variations in poverty and excess mortality among black populations in Massachusetts. *American journal of public health, 95*(2), 260-265.

Suri, H. (2011). Purposeful sampling in qualitative research synthesis. *Qualitative Research Journal, 11*(2), 63-75.

Sutrisno, A., Nguyen, N. T., & Tangen, D. (2014). Incorporating translation in qualitative studies: two case studies in education. *International Journal of Qualitative Studies in Education*, *27*(10), 1337–1353.

Swider, S. M. (2002). Outcome effectiveness of community health workers: an integrative literature review. *Public Health Nursing, 19*(1), 11-20.

Szczepura, A., Johnson, M., Orbell, S., Gumber, A., O'Sullivan, I., Clay, D., & Owen, D. (2003). Ethnicity: UK Colorectal Cancer Screening Pilot, Final Report. *University of Warwick*.

Szczepura, A., Price, C., & Gumber, A. (2008). Breast and bowel cancer screening uptake patterns over 15 years for UK south Asian ethnic minority populations, corrected for differences in socio-demographic characteristics. *BMC Public Health, 8*(1), 346.

Tabachnick, B.G., & Fidell, L. S. (2007). *Using multivariate statistics*. (MA: Allyn & Bacon, Ed.) (5th ed.). Boston.

Tourangeau, R., & Yan, T. (2007). Sensitive Questions in Surveys. *Pyschological Bulletin*, *133*(5), 859–883. https://doi.org/10.1037/0033-2909.133.5.859

Tang, T. S., Solomon, L. J., & McCracken, L. M. (2001). Barriers to Fecal Occult Blood Testing and Sigmoidoscopy Among Older Chinese-American Women. *Cancer Practice, 9*(6), 277-282.

Tarasenko, Y. N., Wackerbarth, S. B., Love, M. M., Joyce, J. M., & Haist, S. A. (2011). Colorectal cancer screening: patients' and physicians' perspectives on decision-making factors. *Journal of Cancer Education, 26*(2), 285-293.

Thomas, J., Thomas, D. J., Pearson, T., Klag, M., & Mead, L. (1997). Cardiovascular disease in African American and white physicians: the Meharry cohort and Meharry-Hopkins cohort studies. *Journal of health care for the poor and underserved, 8*(3), 270-283.

Thomas, V. N., Saleem, T., & Abraham, R. (2005). Barriers to effective uptake of cancer screening among Black and minority ethnic groups. *International journal of palliative nursing, 11*(11), 562-571.

Thompson, B., Coronado, G., Snipes, S. A., & Puschel, K. (2003). Methodologic advances and ongoing challenges in designing community-based health promotion programs. *Annual review of public health, 24*(1), 315-340.

Threlfall, A. G., Meah, S., Fischer, A. J., Cookson, R., Rutter, H., & Kelly, M. P. (2014). The appraisal of public health interventions: the use of theory. *Journal of Public Health, 37*(1), 166-171.

Tinmouth, J., Baxter, N. N., Paszat, L. F., Rabeneck, L., Sutradhar, R., & Yun, L. (2014). Using physician-linked mailed invitations in an organised colorectal cancer screening programme: effectiveness and factors associated with response. *BMJ open, 4*(3), e004494.

Torre, L. A., Bray, F., Siegel, R. L., Ferlay, J., Lortet-Tieulent, J., & Jemal, A. (2015). Global cancer statistics, 2012. *CA: a cancer journal for clinicians, 65*(2), 87-108.

Tourangeau, R., & Yan, T. (2007). Sensitive Questions in Surveys. *Pyschological Bulletin*, *133*(5), 859–883.

Trafimow, D., Sheeran, P., Conner, M., & Finlay, K. A. (2002). Evidence that perceived behavioural control is a multidimensional construct: Perceived control and perceived difficulty. *British journal of social psychology, 41*(1), 101-121.

Trickett, E. J., & Beehler, S. (2013). The ecology of multilevel interventions to reduce social inequalities in health. *American Behavioral Scientist, 57*(8), 1227-1246.

Trivers, K. F., Shaw, K. M., Sabatino, S. A., Shapiro, J. A., & Coates, R. J. (2008). Trends in colorectal cancer screening disparities in people aged 50–64 years, 2000–2005. *American journal of preventive medicine, 35*(3), 185-193.

Truong, M., Paradies, Y., & Priest, N. (2014). Interventions to improve cultural competency in healthcare: a systematic review of reviews. *BMC health services research, 14*(1), 99.

Tu, S. P., Taylor, V., Yasui, Y., Chun, A., Yip, M. P., Acorda, E., . . . Bastani, R. (2006). Promoting culturally appropriate colorectal cancer screening through a health educator. *Cancer, 107*(5), 959-966.

Turiano, N. A., Pitzer, L., Armour, C., Karlamangla, A., Ryff, C. D., & Mroczek, D. K. (2011). Personality trait level and change as predictors of health outcomes: Findings from a national study of Americans (MIDUS). *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 67*(1), 4-12.

Turrin, A., Zorzi, M., Rossi, P. G., Senore, C., Campari, C., Fedato, C., . . . de'Bianchi, P. S. (2015). Colorectal cancer screening of immigrants to Italy. Figures from the 2013 National Survey. *Preventive medicine, 81*, 132-137.

UK Colorectal Cancer Screening Pilot Group. (2004). Results of the first round of a demonstration pilot of screening for colorectal cancer in the United Kingdom. *Bmj, 329*(7458), 133.

Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing & health sciences, 15*(3), 398-405.

Valeri, L., Chen, J. T., Garcia-Albeniz, X., Krieger, N., VanderWeele, T. J., & Coull, B. A. (2016). The role of stage at diagnosis in colorectal cancer black–white survival disparities: a counterfactual causal inference approach. *Cancer Epidemiology and Prevention Biomarkers, 25*(1), 83-89.

Valle, L. (2014). Genetic predisposition to colorectal cancer: where we stand and future perspectives. *World journal of gastroenterology: WJG, 20*(29), 9828.

van Genugten, L., Dusseldorp, E., Webb, T. L., & van Empelen, P. (2016). Which combinations of techniques and modes of delivery in internet-based interventions effectively change health behavior? A meta-analysis. *Journal of medical Internet research, 18*(6).

Van Houtven, C. H., Ramsey, S. D., Hornbrook, M. C., Atienza, A. A., & van Ryn, M. (2010). Economic burden for informal caregivers of lung and colorectal cancer patients. *The oncologist, 15*(8), 883-893.

van Roon, A. H., Hol, L., Wilschut, J. A., Reijerink, J. C., van Vuuren, A. J., van Ballegooijen, M., . . . Kuipers, E. J. (2011). Advance notification letters increase adherence in colorectal cancer screening: a population-based randomized trial. *Preventive medicine, 52*(6), 448-451.

Van Roosbroeck, S., Hoeck, S., & Van Hal, G. (2012). Population-based screening for colorectal cancer using an immunochemical faecal occult blood test: a comparison of two invitation strategies. *Cancer Epidemiology, 36*(5), e317-e324.

Verhagen, I., Steunenberg, B., de Wit, N. J., & Ros, W. J. (2014). Community health worker interventions to improve access to health care services for older adults from ethnic minorities: a systematic review. *BMC health services research, 14*(1), 497.

Vernon, S. W., Bartholomew, L. K., McQueen, A., Bettencourt, J. L., Greisinger, A., Coan, S. P., . . . Myers, R. (2011). A randomized controlled trial of a tailored interactive computer-delivered intervention to promote colorectal cancer screening: sometimes more is just the same. *Annals of behavioral medicine, 41*(3), 284-299.

Vestjens, L., Kempen, G. I., Crutzen, R., Kok, G., & Zijlstra, G. R. (2015). Promising behavior change techniques in a multicomponent intervention to reduce concerns about falls in old age: a Delphi study. *Health education research, 30*(2), 309-322.

Vilkin, A., Rozen, P., Levi, Z., Waked, A., Maoz, E., Birkenfeld, S., & Niv, Y. (2005). Performance characteristics and evaluation of an automated-developed and quantitative, immunochemical, fecal occult blood screening test. *The American journal of gastroenterology, 100*(11), 2519.

Vinker, S., Nakar, S., Rosenberg, E., & Kitai, E. (2002). The role of family physicians in increasing annual fecal occult blood test screening

coverage: a prospective intervention study. *IMAJ-RAMAT GAN-, 4*(6), 424-425.

Viswanathan, M., Ansari, M. T., Berkman, N. D., Chang, S., Hartling, L., McPheeters, M., . . . Tsertsvadze, A. (2012). Assessing the risk of bias of individual studies in systematic reviews of health care interventions.

Von Wagner, C., Baio, G., Raine, R., Snowball, J., Morris, S., Atkin, W., . . . Rainbow, S. (2011). Inequalities in participation in an organized national colorectal cancer screening programme: results from the first 2.6 million invitations in England. *International journal of epidemiology, 40*(3), 712-718.

Von Wagner, C., Good, A., Whitaker, K., & Wardle, J. (2011). Psychosocial determinants of socioeconomic inequalities in cancer screening participation: a conceptual framework. *Epidemiologic reviews, 33*(1), 135-147.

Von Wagner, C., Semmler, C., Good, A., & Wardle, J. (2009). Health literacy and self-efficacy for participating in colorectal cancer screening: the role of information processing. *Patient education and counseling, 75*(3), 352-357.

Wakefield, M. A., Loken, B., & Hornik, R. C. (2010). Use of mass media campaigns to change health behaviour. *The Lancet, 376*(9748), 1261-1271.

Wallace, L., Brown, K., & Hilton, S. (2014). Planning for, implementing and assessing the impact of health promotion and behaviour change interventions: A way forward for health psychologists. *Health psychology review, 8*(1), 8-33.

Waller, J., Osborne, K., & Wardle, J. (2015). Enthusiasm for cancer screening in Great Britain: a general population survey. *British Journal of Cancer*, *112*(3), 562–566.

Wallerstein, N., & Duran, B. (2010). Community-based participatory research contributions to intervention research: the intersection of science and practice to improve health equity. *American journal of public health, 100*(S1), S40-S46.

Walsh, J. M., Salazar, R., Nguyen, T. T., Kaplan, C., Nguyen, L., Hwang, J., . . . Pasick, R. J. (2010). Healthy colon, healthy life: a novel colorectal cancer screening intervention. *American journal of preventive medicine, 39*(1), 1-14.

Walsh, J. M., Salazar, R., Terdiman, J. P., Gildengorin, G., & Pérez-Stable, E. J. (2005). Promoting use of colorectal cancer screening tests. *Journal of general internal medicine, 20*(12), 1097-1101.

Wardle, Williamson, S., McCaffery, K., Sutton, S., Taylor, T., Edwards, R., & Atkin, W. (2003). Increasing attendance at colorectal cancer screening: testing the efficacy of a mailed, psychoeducational intervention in a community sample of older adults. *Health Psychology, 22*(1), 99.

Wardle, J., McCaffery, K., Nadel, M., & Atkin, W. (2004). Socioeconomic differences in cancer screening participation: comparing cognitive and psychosocial explanations. *Social science & medicine, 59*(2), 249-261.

Wardle, J., Miles, A., & Atkin, W. (2005). Gender differences in utilization of colorectal cancer screening. *Journal of medical screening, 12*(1), 20-27.

Wardle, J., von Wagner, C., Kralj-Hans, I., Halloran, S. P., Smith, S. G., McGregor, L. M., . . . Handley, G. (2016). Effects of evidence-based strategies to reduce the socioeconomic gradient of uptake in the English

NHS Bowel Cancer Screening Programme (ASCEND): four cluster-randomised controlled trials. *The Lancet, 387*(10020), 751-759.

WCRF/AICR. (2007). World Cancer Research Fund/American Institute for Cancer Research (2007). *Food, nutrition, physical activity, and the prevention of cancer: a global perspective*.

Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of medical Internet research, 12*(1).

Wei, J., Hollin, I., & Kachnowski, S. (2011). A review of the use of mobile phone text messaging in clinical and healthy behaviour interventions. *Journal of telemedicine and telecare, 17*(1), 41-48.

Weiderpass, E., & Pukkala, E. (2006). Time trends in socioeconomic differences in incidence rates of cancers of gastro-intestinal tract in Finland. *BMC gastroenterology, 6*(1), 41.

Weil, J., Mendoza, A. N., & McGavin, E. (2017). Recruiting older adults as participants in applied social research: Applying and evaluating approaches from clinical studies. *Educational Gerontology*, *43*(12), 662–673.

Weinberg, D. S., Keenan, E., Ruth, K., Devarajan, K., Rodoletz, M., & Bieber, E. J. (2013). A randomized comparison of print and web communication on colorectal cancer screening. *JAMA internal medicine, 173*(2), 122-129.

Weinrich, S. (1990). *Predictors of older adults' participation in fecal occult blood screening.* Paper presented at the Oncology nursing forum.

Weinstein, N. D. (1988). The precaution adoption process. *Health Psychology, 7*(4), 355.

Weinstein, N. D., Rothman, A. J., & Sutton, S. R. (1998). Stage theories of health behavior: conceptual and methodological issues. *Health Psychology, 17*(3), 290.

Weiss, D., Rydland, H. T., Øversveen, E., Jensen, M. R., Solhaug, S., & Krokstad, S. (2018). Innovative technologies and social inequalities in health: A scoping review of the literature. *PloS one, 13*(4), e0195447.

Weller, D., Coleman, D., Robertson, R., Butler, P., Melia, J., Campbell, C., . . . Moss, S. (2007a). The UK colorectal cancer screening pilot: results of the second round of screening in England. *British journal of cancer, 97*(12), 1601.

Weller, D., Coleman, D., Robertson, R., Butler, P., Melia, J., Campbell, C., . . . Moss, S. (2007b). The UK colorectal cancer screening pilot: results of the second round of screening in England. *British journal of cancer, 97*(12), 1601-1605.

Weller, S. C. (2005). Cancer and colorectal cancer: knowledge, beliefs, and screening preferences of a diverse patient population. Fam Med. *Fam Med, 37*(5), 341-347.

Wendler, D., Kington, R., Madans, J., Van Wye, G., Christ-Schmidt, H., Pratt, L. A., . . . Emanuel, E. (2005). Are racial and ethnic minorities less willing to participate in health research? *PLoS medicine, 3*(2), e19.

Wernli, K. J., Hubbard, R. A., Johnson, E., Chubak, J., Kamineni, A., Green, B. B., & Rutter, C. M. (2014). Patterns of colorectal cancer screening uptake in newly eligible men and women. *Cancer Epidemiology and Prevention Biomarkers, 23*(7), 1230-1237.

Whitaker, K. L., Good, A., Miles, A., Robb, K., Wardle, J., & von Wagner, C. (2011). Socioeconomic inequalities in colorectal cancer screening uptake: does time perspective play a role? *Health Psychology, 30*(6), 702.

White, B., Power, E., Ciurej, M., Lo, S. H., Nash, K., & Ormiston-Smith, N. (2015). Piloting the impact of three interventions on guaiac faecal occult blood test uptake within the NHS Bowel Cancer Screening Programme. *BioMed research international, 2015*.

White, S. M., Wójcicki, T. R., & McAuley, E. (2011). Social cognitive influences on physical activity behavior in middle-aged and older adults. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 67*(1), 18-26.

Whitlock, E. P., Lin, J. S., Liles, E., Beil, T. L., & Fu, R. (2008). Screening for Colorectal Cancer: A Targeted, Updated Systematic Review for the US Preventive Services Task ForceScreening for Colorectal Cancer. *Annals of internal medicine, 149*(9), 638-658.

Widdicombe, S., & Wooffitt, R. (1995). *The language of youth subcultures: Social identity in action*: Harvester/Wheatsheaf.

Wilcox, D. (1994). Community participation and empowerment: putting theory into practice. *RRA Notes, 21*, 78-82.

Wild, S., & McKeigue, P. (1997). Cross sectional analysis of mortality by country of birth in England and Wales, 1970-92. *Bmj, 314*(7082), 705.

Wilkinson, R. G., & Marmot, M. (2003). *Social determinants of health: the solid facts*: World Health Organization.

Wilkinson, R. G., & Pickett, K. E. (2007). The problems of relative deprivation: why some societies do better than others. *Social science & medicine, 65*(9), 1965-1978.

Wilkinson, R. G., & Pickett, K. E. (2009). Income inequality and social dysfunction. *Annual Review of Sociology, 35*, 493-511.

Williams, D. R. (1990). Socioeconomic differentials in health: A review and redirection. *Social psychology quarterly*, 81-99.

Williams, D. R., Mohammed, S. A., Leavell, J., & Collins, C. (2010). Race, socioeconomic status, and health: complexities, ongoing challenges, and research opportunities. *Annals of the New York Academy of Sciences, 1186*(1), 69-101.

Wilson, C. J., Flight, I. H., Turnbull, D., Gregory, T., Cole, S. R., Young, G. P., & Zajac, I. T. (2015). A randomised controlled trial of personalised decision support delivered via the internet for bowel cancer screening with a faecal occult blood test: the effects of tailoring of messages according to social cognitive variables on participation. *BMC medical informatics and decision making, 15*(1), 25.

Wilson, K. B., Thorpe Jr, R. J., & LaVeist, T. A. (2017). Dollar for dollar: racial and ethnic inequalities in health and health-related outcomes among persons with very high income. *Preventive medicine, 96*, 149-153.

Wong, M. C., Hirai, H. W., Luk, A. K., Lam, T. Y., Ching, J. Y., Griffiths, S. M., . . . Sung, J. J. (2013). The knowledge of colorectal cancer symptoms and risk factors among 10,078 screening participants: are high risk individuals more knowledgeable? *PloS one, 8*(4), e60366.

Wong, M. D., Ettner, S. L., Boscardin, W. J., & Shapiro, M. F. (2009). The contribution of cancer incidence, stage at diagnosis and survival to racial differences in years of life expectancy. *Journal of general internal medicine, 24*(4), 475-481.

Wong, S. T., Gildengorin, G., Nguyen, T., & Mock, J. (2005). Disparities in colorectal cancer screening rates among Asian Americans and non-Latino whites. *Cancer, 104*(S12), 2940-2947.

Woods, L., Rachet, B., & Coleman, M. (2005). Origins of socio-economic inequalities in cancer survival: a review. *Annals of Oncology, 17*(1), 5-19.

Wübker, A. (2014). Explaining variations in breast cancer screening across European countries. *The European Journal of Health Economics, 15*(5), 497-514.

Yabroff, K. R., Dowling, E. C., Guy Jr, G. P., Banegas, M. P., Davidoff, A., Han, X., . . . Blanch-Hartigan, D. (2016). Financial hardship associated with cancer in the United States: findings from a population-based sample of adult cancer survivors. *Journal of Clinical Oncology, 34*(3), 259.

Yabroff, K. R., & Kim, Y. (2009). Time costs associated with informal caregiving for cancer survivors. *Cancer, 115*(S18), 4362-4373.

Yabroff, K. R., Lund, J., Kepka, D., & Mariotto, A. (2011). Economic burden of cancer in the United States: estimates, projections, and future research. *Cancer Epidemiology and Prevention Biomarkers, 20*(10), 2006-2014.

Yadav, A., Phillips, M. M., Lundeberg, M. A., Koehler, M. J., Hilden, K., & Dirkin, K. H. (2011). If a picture is worth a thousand words is video worth a million? Differences in affective and cognitive processing of video and text cases. *Journal of Computing in Higher Education, 23*(1), 15-37.

Zapka, J. G., Lemon, S. C., Puleo, E., Estabrook, B., Luckmann, R., & Erban, S. (2004). Patient education for colon cancer screening: a randomized trial of a video mailed before a physical examination. *Annals of internal medicine, 141*(9), 683-692.

Zapka, J. G., Stoddard, A. M., Costanza, M. E., & Greene, H. L. (1989). Breast cancer screening by mammography: utilization and associated factors. *American journal of public health, 79*(11), 1499-1502.

Zauber, A. G., Lansdorp-Vogelaar, I., Knudsen, A. B., Wilschut, J., van Ballegooijen, M., & Kuntz, K. M. (2008). Evaluating test strategies for colorectal cancer screening: a decision analysis for the US Preventive Services Task Force. *Annals of internal medicine, 149*(9), 659-669.

Appendices

Appendix 2.1. Protocol of meta-analysis registered on PROSPERO.

PROSPERO International prospective register of systematic reviews

Review title and timescale

1 Review title
Give the working title of the review. This must be in English. Ideally it should state succinctly the interventions or exposures being reviewed and the associated health or social problem being addressed in the review.
Which interventions are effective in increasing bowel cancer screening adherence? A systematic review and meta-analysis of randomised controlled trials

2 Original language title
For reviews in languages other than English, this field should be used to enter the title in the language of the review. This will be displayed together with the English language title.

3 Anticipated or actual start date
Give the date when the systematic review commenced, or is expected to commence.
01/01/2015

4 Anticipated completion date
Give the date by which the review is expected to be completed.
01/05/2017

5 Stage of review at time of this submission
Indicate the stage of progress of the review by ticking the relevant boxes. Reviews that have progressed beyond the point of completing data extraction at the time of initial registration are not eligible for inclusion in PROSPERO. This field should be updated when any amendments are made to a published record.

The review has not yet started ×

Review stage	Started	Completed
Preliminary searches	Yes	Yes
Piloting of the study selection process	Yes	Yes
Formal screening of search results against eligibility criteria	Yes	No
Data extraction	Yes	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

Provide any other relevant information about the stage of the review here.

Review team details

6 Named contact
The named contact acts as the guarantor for the accuracy of the information presented in the register record.
Miss Tsipa

7 Named contact email
Enter the electronic mail address of the named contact.
ps11ait@leeds.ac.uk

8 Named contact address
Enter the full postal address for the named contact.
School of Psychology, University of Leeds, LS2 9JT, Leeds, West Yorkshire, UK

9 Named contact phone number
Enter the telephone number for the named contact, including international dialing code.

10 Organisational affiliation of the review
Full title of the organisational affiliations for this review, and website address if available. This field may be completed as 'None' if the review is not affiliated to any organisation.
University of Leeds
Website address:
www.leeds.ac.uk

11 Review team members and their organisational affiliations
Give the title, first name and last name of all members of the team working directly on the review. Give the organisational affiliations of each member of the review team.

Title	First name	Last name	Affiliation
Miss	Anastasia Isavella	Tsipa	School of Psychology, University of Leeds, UK
Professor	Daryl	O'Connor	School of Psychology, University of Leeds, UK
Professor	Mark	Conner	School of Psychology, University of Leeds, UK
Dr	Fiona	Day	National Health System, Leeds City Council
Dr	Natalie	Taylor	Macquarie University, Sydney, Australia
Miss	Louise	Hall	School of Psychology, University of Leeds, UK
Dr	Dawn	Branley	School of Psychology, University of Leeds, UK
Dr	Bianca	Sykes-Muskett	School of Psychology, University of Leeds, UK

12 Funding sources/sponsors
Give details of the individuals, organizations, groups or other legal entities who take responsibility for initiating, managing, sponsoring and/or financing the review. Any unique identification numbers assigned to the review by the individuals or bodies listed should be included.
This review is conducted as part of a PhD studentship which is jointly funded by the School of Psychology, University of Leeds and the Leeds City Council.

13 Conflicts of interest
List any conditions that could lead to actual or perceived undue influence on judgements concerning the main topic investigated in the review.
Are there any actual or potential conflicts of interest?
None known

14 Collaborators
Give the name, affiliation and role of any individuals or organisations who are working on the review but who are not listed as review team members.

Title First name Last name Organisation details

Review methods

15 Review question(s)
State the question(s) to be addressed / review objectives. Please complete a separate box for each question.
Which interventions are effective in increasing bowel cancer screening adherence?

16 Searches
Give details of the sources to be searched, and any restrictions (e.g., language or

publication period). The full search strategy is not required, but may be supplied as a link or attachment.
We searched MEDLINE (1950-), EMBASE (1947-), and PsycINFO (1806-) using OVID. Searches were restricted to articles in the English language.

17 URL to search strategy
If you have one, give the link to your search strategy here. Alternatively you can e-mail this to PROSPERO and we will store and link to it.

I give permission for this file to be made publicly available
No

18 Condition or domain being studied
Give a short description of the disease, condition or healthcare domain being studied. This could include health and wellbeing outcomes.
Colorectal cancer screening adherence.

19 Participants/population
Give summary criteria for the participants or populations being studied by the review. The preferred format includes details of both inclusion and exclusion criteria.
Studies were included if they recruited participants that were at least 50 years of age and had no family history of colorectal cancer.

20 Intervention(s), exposure(s)
Give full and clear descriptions of the nature of the interventions or the exposures to be reviewed
Studies were included that tested the effect of an intervention (of any intensity) on increasing colorectal cancer screening adherence. Studies that did not measure and report colorectal cancer screening rates as an outcome were excluded.

21 Comparator(s)/control
Where relevant, give details of the alternatives against which the main subject/topic of the review will be compared (e.g., another intervention or a non-exposed control group).
The main interventions were compared against alternative interventions, usual care, no-intervention control groups and/or delayed treatment conditions.

22 Types of study to be included
Give details of the study designs to be included in the review. If there are no restrictions on the types of study design eligible for inclusion, this should be stated.
Studies to be included are restricted to a randomised controlled trial study design. As such, studies that were descriptive, including survey and qualitative studies, and studies that were observational, including cohort, cross-sectional and case-control studies, were excluded.

23 Context
Give summary details of the setting and other relevant characteristics which help define the inclusion or exclusion criteria.
Studies were included if they incorporated screening adherence by using guaiac Fecal Occult Blood Test (gFOBT), Fecal Immunochemical Test (FIT), Flexible Sigmoidoscopy (FS), colonoscopy or barium enema. Studies were excluded if they were an abstract, a dissertation, a review, a protocol, a poster, a think-piece or guidelines. Studies were excluded if they were not reported in English. Studies that did not report statistics in the results or were subset or secondary analyses to previous papers, were excluded.

24 Primary outcome(s)
Give the most important outcomes.
To assess whether certain interventions are more effective than others in increasing colorectal cancer screening uptake (both self-reported and based on objective measures).

Give information on timing and effect measures, as appropriate.
Screening adherence must be reported post-intervention. Where studies had more than one experimental groups compared with a single control condition, the number of participants in the control condition was evenly divided across the experimental conditions to ensure each participant was included only once in the analysis. Where there are multiple time-points within a study, the last time-point will be used to calculate an effect size.

25 Secondary outcomes
List any additional outcomes that will be addressed. If there are no secondary outcomes enter None.
To assess whether sociodemographic factors, such as gender and socioeconomic status, moderate the intervention effect on colorectal cancer screening adherence
To assess whether the use of theory in a given intervention moderates the intervention effect on colorectal cancer screening adherence.

Give information on timing and effect measures, as appropriate.

26 Data extraction (selection and coding)
Give the procedure for selecting studies for the review and extracting data, including the number of researchers involved and how discrepancies will be resolved. List the data to be extracted.
Titles and abstracts of studies retrieved using the search strategy and those from additional sources will be screened independently by one member of the review team to identify studies that potentially meet the inclusion criteria outlined above. The full text of these potentially eligible studies will be retrieved and independently assessed for eligibility by one member of the research team. A standardised, pre-piloted form will be used to extract data from the included studies for assessment of study quality and evidence synthesis. Extracted information will include: details of the intervention and control conditions; study population and participant demographics and baseline characteristics; study setting; study methodology; suggested mechanisms of intervention action; information for assessment of the risk of bias; identified behaviour change techniques; use of theory; mode of delivery; bowel cancer screening outcomes. Two review authors will extract data independently and discrepancies will be identified and resolved through discussion (with a third author where necessary). Missing data will be requested from study authors.

27 Risk of bias (quality) assessment
State whether and how risk of bias will be assessed, how the quality of individual studies will be assessed, and whether and how this will influence the planned synthesis.
Bias risk will be assessed using the Cochrane Collaboration's tool for assessing risk of bias. Based on the Cochrane guidelines, risk of bias in included studies is assessed by considering the following characteristics: 1) Random sequence generation (selection bias) 2) Allocation concealment (selection bias) 3) Blinding of participants & personnel (performance bias) 4) Blinding of outcome assessment (detection bias) 5) Incomplete outcome data (attrition bias) 6) Selective reporting (reporting bias) Risk of bias for included studies in the present review was further assessed by considering whether studies followed an intention-to-treat analysis.

28 Strategy for data synthesis
Give the planned general approach to be used, for example whether the data to be used will be aggregate or at the level of individual participants, and whether a quantitative or narrative (descriptive) synthesis is planned. Where appropriate a brief outline of analytic approach should be given.
Effect sizes will be calculated for each study reflecting the impact of the intervention on colorectal cancer screening adherence. Where there are multiple subgroups within a study, an average effect across subgroups will be computed. Where there are multiple time-points within a study, a single effect size will be

computed. Meta-analyses will be conducted to estimate overall effect size with meta-regression to test the association between specific sociodemographic variables, intervention characteristics and specific behaviour change techniques, and intervention effect size.

29 Analysis of subgroups or subsets
Give any planned exploration of subgroups or subsets within the review. 'None planned' is a valid response if no subgroup analyses are planned.
Post-hoc sensitivity analyses will be conducted to examine the impact of removing studies - That did not follow an intention-to-treat analysis - That were assessed as being of high risk of bias - That involved endoscopic screening procedures only

Review general information

30 Type and method of review
Select the type of review and the review method from the drop down list.
Intervention, Systematic review

31 Language
Select the language(s) in which the review is being written and will be made available, from the drop down list. Use the control key to select more than one language.
English
Will a summary/abstract be made available in English?
Yes

32 Country
Select the country in which the review is being carried out from the drop down list. For multi-national collaborations select all the countries involved. Use the control key to select more than one country.
England

33 Other registration details
Give the name of any organisation where the systematic review title or protocol is registered together with any unique identification number assigned. If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here.

34 Reference and/or URL for published protocol
Give the citation for the published protocol, if there is one.
Give the link to the published protocol, if there is one. This may be to an external site or to a protocol deposited with CRD in pdf format.

I give permission for this file to be made publicly available
Yes

35 Dissemination plans
Give brief details of plans for communicating essential messages from the review to the appropriate audiences.
A summary report will be produced prior to preparing a paper for publication.
Findings will be presented at conferences.
Do you intend to publish the review on completion?
Yes

36 Keywords
Give words or phrases that best describe the review. (One word per box, create a new box for each term)
colorectal cancer screening
interventions
screening adherence

37 Details of any existing review of the same topic by the same authors

Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible.

38 Current review status
Review status should be updated when the review is completed and when it is published.
Ongoing

39 Any additional information
Provide any further information the review team consider relevant to the registration of the review.

40 Details of final report/publication(s)
This field should be left empty until details of the completed review are available.
Give the full citation for the final report or publication of the systematic review.
Give the URL where available.

Appendix 2.2. Data extraction form

General Information **Title of Research:** Effectiveness of public health interventions to increase colorectal cancer screening: a systematic review and meta-analysis. **Research team:** Anastasia Tsipa, Mark Conner, Daryl O'Connor, Dawn Branley, Fiona Day, Louise Hall, Bianca Sykes-Muskett, Natalie Taylor		
Researcher performing data extraction:		
Date form completed:		
Author:	Year of publication:	Country:
Article Title:		
Study Characteristics		
Aims of study clearly stated: YES / NO		
Study Design clearly stated: YES / NO		
Participant Characteristics – Intervention Group:		
Age (m/SD):	Gender:	
Ethnicity:		
SES:		
History of CRC cancer: Familial history of CRC:	Yes / No Yes / No	
Average number of past screening invites		
Ever had gFOBT (%yes)		
Ever had any CRC screening (%yes)		
Up-to-date with screening at baseline (%yes)		
Comorbidities:	Yes / No	
N =		
Participant Characteristics – Comparison Group:		
Age (m/SD):	Gender:	
Ethnicity:		
SES:		
Personal history of CRC cancer: Familial history of CRC:	Yes / No Yes / No	

Average number of past screening invites	
Ever had gFOBT (%yes)	
Ever had any CRC screening (%yes)	
Up-to-date with screening at baseline (%yes)	
Comorbidities	Yes / No
N =	
Total number of study participants =	
Intervention and Setting	
Setting:	
Type of Intervention:	
Description of Intervention: • Delivery: group/individual • Provider • Contact type: face-to-face/remote • Intervention materials: e.g., paper-based/phone/mixed and content of materials • Use of theory: yes/no and what theory (or theories). Report use of theory using Theory Coding Scheme table • Use of reminders: yes/no • BCTs: report use of BCTs in both intervention and control groups in Excel file (using 0 and 1 to indicate the presence and absence of a BCT respectively). Report also total number of BCTs used in intervention.	
Number of contacts in Intervention condition	
Number of contacts in Control condition	
Number of contacts with physician (if applicable)	
Duration / Follow-up time points:	
Description of co-interventions (if applicable):	
Outcome Data – Results	
Statistical Analysis:	
Primary Outcome: Completed CRC screening	
Definition of outcome used in study:	
Screening modality:	
Length of follow-up:	
Times of follow-up measurement:	
Outcome Assessment	Objective / Self-report

Secondary Outcomes: e.g., Intention, knowledge (if so, report whether these measured and how)	
Risk of bias based on Cochrane Risk of Bias tool (assess using designated risk of bias table and report outcome here)	Low risk / unclear risk / high risk
Summary Outcome Data:	
Author's Conclusion:	
Include / Exclude	
Reason for Exclusion	
General Comments	

Appendix 2.3. Description of studies coded as low SES

Study ID, Year, Country of Publication	Study design (arms)	Setting	Low SES classification	Extracts from study supporting classification
1. Aragones et al (2010) USA	RCT (2)	Primary care clinic of a large NYC teaching hospital	• Ethnic minority population (Latino immigrants)	'This study tested the effectiveness of a culturally and linguistically sensitive, multi-level intervention to improve CRC screening rates in an urban, Latino immigrant population.' (pg. 565) 'We conducted a randomized controlled trial in the primary care clinic of a large New York City teaching hospital caring for a large, diverse, underserved population.' (pg. 565)
2. Baker et al (2014) USA	RCT (2)	Community health centres in Chicago, Illinois	• Low SES • Ethnic minority population (predominantly Latino) • Low health literacy	'87% of participant were Latino; 83%stated that Spanish was their preferred language; and 77%were uninsured.' (pg. 1235) 'Even among a vulnerable population with low socioeconomic status, high rates of no insurance, limited English proficiency, and low health literacy, our multifaceted intervention achieved a rate of adherence to annual gFOBT screening (82.2%) far

			• Without health insurance	above the usual care group (37.3%).' (pg. 1240)
3. Basch et al (2006) USA	RCT (2)	Health benefits programme in NYC	• Ethnic minority population (100% African-American)	'We therefore conducted a randomized trial to evaluate tailored telephone outreach compared with mailed printed material to increase CRC screening in a predominantly Black population of low to moderate income.' (pg. 2246)
4. Blumenthal et al (2010) USA	RCT (4)	Community sites (e.g., churches) in Atlanta	• Ethnic minority population (100% African-American)	'For the current study, the authors tested 3 interventions that were intended to increase the rate of CRC screening among African Americans.' (p.g 922)
5. Christie et al (2008) USA	RCT (2)	Community health centre in NYC	• Ethnic minority population (mainly Hispanic) • Low level of education	'This prospective clinical trial was approved by the institutional review board and designed to determine whether a patient navigator enhances CRC screening by colonoscopy in minorities who completed a visit with his/her primary care physician and received a referral for screening colonoscopy. (pg. 279)' 'Most patients were uninsured or had public insurance (Table 1). The average age was 58 years old (range = 49–70). Seventy-five percent were females and 71% Hispanic. The majority of patients had less than a high-school education and earned <$20,000 per year.' (pg. 282)
6. Coronado et a (2011) USA	RCT (3)	Community clinic in Seattle	• Ethnic minority population (100% Hispanic)	'Specifically, we tested an individual randomized trial wherein patients of Hispanic ethnicity between the ages of 50 and 79 years were assigned to 1 of 3 conditions: 1) usual care; 2) mailed gFOBT card and instructions on how to complete the test (mailed gFOBT only); and 3) mailed gFOBT card and instructions on how to complete the test, telephone reminders, and home visits (mailed gFOBT and outreach).' (pg. 1746)

				'More than half of respondents were aged 50 to 59 years, the majority were female, and three-quarters had less than a high school education (Table 2). The remainder had a high school diploma or GED (13%) or had completed some college (12%). Slightly more than one-quarter of respondents had private healthcare coverage. Less than 20% were covered by the Washington State Basic Health Care Plan. Nearly one-quarter of respondents reported either relying on a government plan (Medicare, Medicaid, or medical coupons) or having no healthcare insurance' (pg. 1749)
7. Dietrich et al (2006) USA	RCT (2)	Community and migrant health centres in NYC	• Ethnic minority • Low-income	'Objective—To evaluate the effect of a telephone support intervention to increase rates of breast, cervical, and colorectal cancer screening among minority and low-income women.' (pg. 2) 'Over two thirds of women (68%) had been receiving care from their health center for at least 3 years. Many women had chronic disease, and more than half were obese. Ethnicity and income are not presented in Table 2 because ethnicity was unknown for 39% of women and income was inferred from the participants' home ZIP codes. Of those with documented ethnicity, 38% were black and 39% were white. More than one third (34%) of women lived in ZIP codes with a median household income of less than $25 000, 39% lived in ZIP codes with a median income between $25 000 and $40000, and 27% lived in ZIP codes with a median income of greater than $40 000.' (pg. 6-7)
8. Dietrich et al (2007) USA	RCT (2)	Community health centres in NYC	• Low-income • Medicaid insurance	'This study evaluated the impact of a streamlined Prevention care management (PCM) delivered through a Medicaid managed care organization (MMCO), an infrastructure with the potential to sustain this program for the long term.' (pg. 320) 'Dartmouth Medical School,

				Affinity Health Plan and Clinical Directors Network22 collaborated on this project. Affinity was founded in 1986 as an independent, not-for-profit managed care company dedicated to serving the needs of low- and moderate-income populations in and around New York City.' (pg. 321)
9. Dietrich et al (2013) USA	RCT (2)	Medicaid community health centres in NYC	• Low-income • Medicaid insurance	'We explored whether telephone outreach, delivered by Medicaid managed care organization (MMCO) staff, could increase colorectal cancer (CRC) screening among publicly insured urban women, potentially reducing disparities.' (pg. 335)
10. Ferreira et al (2005) USA	RCT (2)	Primary care outpatient firms at a Veteran Affairs (VA) Medical Centre in Chicago	• Largely ethnic minority population • Poor literacy • Low level of education	'More than half of the VA users report an income below $20,000, and only 58% have a 12th grade education level. Many have limited literacy skills and are unable to read or understand health-related materials.' (pg. 1549) 'Our study population included male veterans, approximately half of whom were African American, who were at average risk for colorectal cancer and who were currently not compliant with colorectal cancer screening.' (pg. 1552)
11. Fiscella et al (2011) USA	RCT (2)	An inner city, family, medicine practice in NYC	• Low SES population	*'Objective:* To examine the impact of a multimodal intervention on mammography and colorectal cancer (CRC) screening rates in a safety-net practice caring for underserved patients. (pg. 762) 'We recruited one large family medicine safety-net practice in upstate New York to participate in the intervention. We specifically targeted a practice that served large numbers of low-income and minority patients.' (pg. 763)
12. Fitzgibbon et al (2007) USA	RCT (2)	Primary care clinics in a Veteran Affairs medical centre in Chicago	• Largely ethnic minority population • Poor literacy	'The VA Health Study found that 58% of veterans had a 12th grade high school education or lower, more than half had an income below $20,000, and more than 45% were African-American.' (pg. 273-274)

			• Low level of education	'The average age (*SD*) for all eligible patients was 67.9 years (10.6 years), and the ethnic breakdown was evenly split between Blacks and Whites, with only 5% in the "Other" category.' (pg. 277)
13. Ford et al (2006) USA	RCT (2)	A cancer screening trial site in Detroit	• Ethnic minority population (100% African-American)	'The purpose of this study was to enhance adherence among older (aged 55 years and older) African American men enrolled in a cancer screening trial for prostate, lung, and colorectal cancer.' (pg. 545)
14. Fortuna et al (2014) USA	RCT (4)	Urban, internal medicine practice in NYC	• Predominantly ethnic minority population • Low-income • Medically underserved setting	'We examined the reminder, recall and outreach (RRO) model in an urban internal medicine practice in Rochester, New York, a city of ~211,000 inhabitants (37.6 % non-Hispanic white, 41.7 % black). The study practice cared for a largely low-income and disproportionately minority patient population, and was situated in an urban federal-designated underserved setting.' (pg. 91)
15. Goldberg et al (2004) USA	RCT (2)	Urban, public hospital in Boston	• Predominantly ethnic minority population (African-American) • Low-income • Population with multiple chronic illnesses	'A total of 119 patients with primary care appointments scheduled in May or June 2000 for an urban, public hospital clinic that serves predominantly low-income, African Americans with chronic diseases.' (pg. 431)
16. Goldman et al (2015) USA	RCT (2)	A health centre network based in Chicago	• Largely ethnic minority population • Uninsured • Never screened before for CRC • One or	'The study was conducted at Erie Family Health Center (EFHC), a federally qualified health center network based in Chicago, Illinois with eight clinics serving adult patients. At EFHC, 55 % of patients are best served in Spanish, 95 % fall below 200 % of the federal poverty line, and 35 % are uninsured.' (pg. 1179) 'In the final sample, patients' mean age was 57.3 years (SD=6.2),

			more chronic illnesses	66.0 % were female, 62.1 % identified their race/ethnicity as Latino/Hispanic (79.7 % Spanish- and 20.3 % English-speaking), 70.7 % were uninsured, and 74.8 % had one or more chronic medical conditions.' (pg. 1181)
17. Gupta et al (2013) USA	RCT (3)	A safety net health system in Texas	• Predominantly ethnic minority population • Uninsured	'We conducted a randomized, comparative effectiveness trial among underserved patients, not up to date with CRC screening. Our aims were to determine (1) if organized mailed outreach boosts screening compared with usual care and (2) if FIT is superior to colonoscopy outreach for screening participation.' (pg. 1726) 'The sample was 24% black, 29% Hispanic, 7% other race/ethnicity and 41% White. The primary language was Spanish for 17%of all patients.' (pg. 1727)
18. Hendren et al (2013) USA	RCT (2)	An inner city, primary care family practice in NYC	• Low-income • Large ethnic minority population • Large proportion insured with Medicaid or no insurance	'We sought to combine lower cost, feasible interventions into a multimodal cancer screening promotion for mammography and colorectal cancer screening for low income patients past due for screening.' (pg. 42) 'A large primary care practice in Rochester, New York, serving a large proportion of low-income and minority patients was recruited to participate' (pg. 42)
19. Holt et al (2012) USA	RCT (2)	African American churches in Alabama	• Ethnic minority population (100% African-American)	'The purpose of the present study was to evaluate the efficacy of a spiritually based CHA intervention aimed at increasing CRC screening among African Americans in church settings, using a group randomized controlled design.' (pg. 459)
20. Horne et al (2015) USA	RCT (2)	Medicare health centres and community-based venues	• Ethnic minority population (100% African-American) • Medicare insurance	'In a community-based randomized controlled trial, we investigated the effect of patient navigation on increasing CRC screening adherence among older African Americans.' (pg. 2) 'Participants were deemed eligible for the study if they were a Baltimore City resident, aged 65 and older, and enrolled in Medicare Parts A and B.' (pg. 3)

21. Jandorf et al (2013) USA	RCT (3)	Primary care clinic in NYC	• Ethnic minority population (100% African-American) • Low income • Predominantly Medicare/Medicaid insurance	'This study focuses on predicting outcomes of screening colonoscopy for colorectal cancer among African Americans using different patient navigation formats.' (pg. 1577)
22. Jean-Jacques et al (2012) USA	RCT (2)	Community health centres, Chicago	• Low-income • Predominantly ethnic minority population • Limited English proficiency	'We examined whether the direct mailing of gFOBT kits to patients overdue for such screening is an effective way to improve screening in a poor, racial and ethnic minority population, and individuals with limited English proficiency.' (pg. 412) 'This study was conducted at Heartland International Health Center (HIHC), a federally qualified health center that provides comprehensive primary care to a predominantly low income, uninsured, and racially diverse population on the north side of Chicago, Illinois.' (pg. 413)
23. Katz et al (2012) USA	RCT (2)	Community health centre, Ohio	• Predominantly ethnic minority population • Low-income • Predominantly without health insurance • Limited health literacy skills	'Patients were African American (72.2%), female (63.7%), had annual household incomes less than $20,000 (60.7%), no health insurance (57.0%), and limited health literacy skills (53.7%).' (pg. 1) 'The study was conducted from November 2007 to May 2010 in one Federally Qualified Health Center (FQHC) that serves a mostly minority and low SES population in Columbus, Ohio.' (pg. 2)
24. Lasser et al (2011) USA	RCT (2)	Community health centres, Massachusetts	• Predominantly ethnic minority, non-	'We identified 465 primary care patients from 4 community health centers and 2 public hospital–based clinics who were not up-to-date with CRC screening and spoke English, Haitian Creole,

			English speaking population • Low-income • Majority had low-cost or no-cost health insurance coverage	Portuguese, or Spanish as their primary language.' (pg. 906) 'To build on this limited research, we conducted a randomized controlled trial of patient navigation that included immigrants from the Azores, Brazil, Haiti, and Portugal receiving care at 4 different health centers and 2 public hospital–based clinics in the safety net health care system (ie, a health care system that provides a significant level of care to low-income, uninsured and vulnerable populations.' (pg. 907)
25. Maxwell et al (2010) USA	RCT (3)	Community-based organisations and churches in Los Angeles	• Ethnic minority population (100% Filipino-Americans)	'We conducted 1 of the first community-based trials to develop a multicomponent intervention that would increase colorectal cancer screening among an Asian American population.' (pg. 2228)
26. Maxwell et al (2015) USA	RCT (2)	Community-based organisations	• Ethnic minority population (100% Filipino-Americans)	'The aim of this study is to evaluate two strategies to implement an evidence-based intervention to promote CRC screening in Filipino American community organizations.' (pg. 296)
27. Menon et al (2011) USA	RCT (3)	Medical centres	• Predominantly ethnic minority sample • Low-income	'The majority of our sample was male (69.7%), African American (72.4%), and currently not working (79%).' While more than half of the participants had a bachelor's degree or higher (55.3%), almost half had an income of less than $15,000 per year (48.5 %). Less than a third of participants were married or had a partner (28.2%). The majority of participants were recruited from the VA sites (65%).' (pg. 6)
28. Percac-Lima et al (2008) USA	RCT (2)	Community health centre	• Predominantly ethnic minority sample • Low-income	'OBJECTIVE: To evaluate a culturally tailored intervention to increase CRC screening, primarily using colonoscopy, among low income and non-English speaking patients.' (pg 211) 'The study was set at MGH Chelsea HealthCare Center is the largest provider of care for the residents of Chelsea, MA, a city of

				35,080 people that has been a gateway for refugees and immigrants for more than a century. Recent immigrants have come from Bosnia, Somalia, Afghanistan, Northern and Western Africa, and Central America. Latinos account for more than 48% of Chelsea's population. More that 58% of residents speak languages other than English, and nearly 44% speak only Spanish. Poverty levels are more than twice the state-wide average: More than 27% of households earn less than $15,000 annually and 43% live below 200% of national poverty thresholds.' (pg. 212)
29. Price-Haywood et al (2014) USA	RCT (2)	Community clinics in New Orleans	• Predominantly ethnic minority population • Limited health literacy	'We designed a continuing medical education (CME) program to teach primary care physicians (PCP) how to engage in cancer risk communication and shared decision making with patients who have limited health literacy (HL).' (pg 1113) 'This 4-year study (2008 to 2012) targeted seven clinics in New Orleans that serve patients at risk for low HL—minorities, middle-aged or older, publicly insured and uninsured.' (pg. 1114)
30. Resnicow et al (2014) USA	RCT (2)	Integrated, health care, delivery system in greater Detroit	• Ethnic minority population (100% African-Americans)	'Objective: Test the impact of tailoring CRC screening messages for African Americans (AAs) using novel theoretical variables and to examine moderating effect of communication preferences.' (pg. 370)
31. Roetzheim et al (2004) USA	RCT (2)	Primary care clinics in Florida	• Predominantly ethnic minority population • Medically underserved population; majority had low-cost or no-cost	'We assessed the efficacy of the Cancer Screening Office Systems (Cancer SOS), an intervention designed to increase cancer screening in primary care settings serving disadvantaged populations.' (pg. 294) 'To target an underserved population, clinics were recruited from among 16 clinics participating in a county-funded health insurance plan in Hillsborough County, Fla. The county health plan provides health care for uninsured persons who do not

			health insurance coverage • Majority (>65%) had more than 5 chronic illnesses	qualify for Medicaid or Medicare and who have a serious chronic health condition.' (pg. 295)
32. Shanklema n et al (2014) UK	RCT (3)	GP surgeries in London	• Areas with populatio ns of low income and ethnic diversity in London	'We report on the evaluation of two interventions to improve uptake in an area including populations of low socioeconomic status and considerable ethnic diversity.'(pg. 1440)
33. Stokamer et al (2004) USA	RCT (2)	Veteran Affairs primary care clinic in NYC	• Predomin antly ethnic minority populatio n	'The majority of study participants were male, and the patients were racially/ethnically diverse.' (pg 280)
34. Tu et al (2006) USA	RCT (2)	Community clinic in Seattle	• Ethnic minority populatio n (100% Chinese-American s) • Low-income	'To promote CRC screening among lower-income and less-acculturated Chinese Americans, we conducted a randomized controlled trial to evaluate a clinic-based, culturally appropriate program that promoted gFOBT screening through a health educator.' (pg. 960)
35. Walsh et al (2010) USA	RCT (3)	Public hospital in Santa Clara	• Ethnic minority populatio n (100% Latino and Vietname se)	'In this context, this study addressed the following question: Can an intervention that includes culturally tailored brochures with or without tailored telephone counselling increase rates of CRC screening among Latinos and Vietnamese seen in primary care clinics? To our knowledge, no prior studies have assessed the effect of a culturally and individually tailored intervention to increase CRC screening in diverse underserved populations.' (pg. 3)
36. Wardle et al (2003) UK	RCT (2)	GP surgeries in London	• Medically underser ved areas of London (e.g.,	'The intervention materials addressed the multiple barriers shown to be associated with participation in earlier studies. Adults ages 55–64 (*N* _ 2,966), in a "harder-to-reach" group were

			Tower Hamlets) and 'hard-to-reach' population	randomized either to receive an intervention brochure or to a standard invitation group.' (pg. 99) 'To select a "harder-to-reach" group, the sampling frame for the present study consisted of people who were in the screening arm of the main trial and had said that they would only probably accept the screening invitation.' (pg. 100)

Appendix 2.4. Studies[a] assessed for their reported theory use across items 3-11 of the Theory Coding Scheme (Michie & Prestwich, 2010)

Study	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Overall Use of Theory Score (0 – 8)	Classification
1. Braun et al (2005)	0	0	1	0	0	1	1	0	1	4	Moderate use of theory
2. Costanza et al (2007)	1	0	1	1	0	1	0	2	0	6	High use of theory
3. Fitzgibbon et al (2007)	1	0	1	0	0	1	0	0	1	4	Moderate use of theory
4. Gimeno-Garcia et al (2009)	1	0	1	0	2	0	0	0	1	5	Moderate use of theory
5. Hendren et al (2011)	1	0	1	0	0	1	0	0	1	4	Moderate use of theory
6. Hewitson et al (2011)	0	0	1	0	2	1	0	0	0	4	Moderate use of theory
7. Holt et al (2012)	1	0	1	0	0	1	1	2	1	6	High use of theory
8. Jensen et al (2014)	0	0	1	1	0	1	1	0	1	5	Moderate use of theory
9. Katz et al (2015)	1	0	1	0	0	1	0	2	0	5	Moderate use of theory
10. Krok-Schoen et al (2015)	0	0	1	0	0	1	1	0	1	4	Moderate use of theory
11. Lo et al (2013)	1	0	1	0	2	0	0	2	0	6	High use of theory
12. Marcus et al (2005)	0	0	1	1	0	1	1	0	1	5	Moderate use of theory
13. Menon et al (2011)	0	0	1	1	2	0	1	2	0	5	Moderate use of theory
14. Myers et al (2007)	0	0	1	1	0	1	1	0	1	5	Moderate use of theory
15. Neter et al (2014)	1	0	1	0	2	0	0	2	0	6	High use of theory
16. O'Carroll et al (2015)	0	0	1	1	2	0	0	2	0	6	High use of theory
17. Potter et al (2011)	0	0	0	0	0	0	0	0	0	0	Low use of theory
18. Price-Haywood et al (2014)	0	0	0	0	0	0	1	0	0	1	Low use of theory

19.	Resnicow et al (2014)	1	0	1	1	2	0	0	0	1	6	High use of theory
20.	Ritvo et al (2015)	0	0	0	0	0	0	0	0	0	0	Low use of theory
21.	Ruffin et al (2007)	1	0	0	0	0	0	1	0	0	2	Low use of theory
22.	Salimzadeh et al (2014)	0	0	1	0	2	0	0	0	1	4	Moderate use of theory
23.	Vernon et al (2011)	1	0	0	0	0	0	0	0	0	1	Low use of theory
24.	Walsh et al (2010)	1	0	1	1	2	0	0	2	0	7	High use of theory
25.	Wardle et al (2003)	0	0	1	0	0	1	0	0	1	3	Moderate use of theory
26.	Weinberg et al (2013)	1	0	1	1	0	1	0	0	1	5	Moderate use of theory
27.	Wilson et al (2015)	0	0	1	1	2	0	0	0	1	5	Moderate use of theory
28.	Zapka et al (2004)	0	0	0	0	0	0	0	0	0	0	Low use of theory

Notes. [a]This applied only to studies that reported using theory to develop the intervention either in the introduction or methods sections (k = 44).

Appendix 2.5. Overview and coding strategy for moderators included in the meta-analysis.

Moderator Variable	Category	Description	Example studies
Contact Type	Face-to-face contact	The intervention was delivered face-to-face.	• Ganz et al (2005): The study involved a series of face-to-face workshops and meetings as part of a quality improvement intervention. • Ornstein et al (2010): The study involved a series of practice site visits and meetings as part of a quality improvement intervention. • Stokamer et al (2004): Patients received direct, one-to-one educational sessions by nurses.
	Remote contact	The intervention was not delivered face-to-face and used a variety of modes such as standard mail, internet and telephone.	• Green et al (2013): Groups 1-3 received a variation of an intervention using automated mailings linked to patients' electronic health records. • Lewis et al (2012): Participants received an educational letter signed by their physician. • Wardle et al (2016): Participants in the four cRCTs received print materials each comprising of slightly different content.
	Mixed contact	Intervention incorporated some elements that were delivered face-to-face and others that were delivered remotely.	• Braun et al (2005): The intervention involved both face-to-face educational sessions (face-to-face component) and reminder telephone calls (remote component). • Roetzheim et al (2004): The study involved both direct-contact feedback sessions with clinic staff delivering the intervention (face-to-face component) but also staff were given print training manuals (remote component). • Tu et al (2006): The intervention involved direct-contact educational sessions with a health educator (face-to-face component) and also participants viewed a video and received a pamphlet (remote components).
Intervention Delivery Format	Individual (i.e. one-to-one) delivery	The intervention was delivered on a one-to-one basis.	• Atlas et al (2014): Primary care providers provided individualised contact (via a letter, practice delegate or patient navigator) to patients overdue for CRC screening.

			• Fortuna et al (2014): Each participant received either a reminder letter, an automated telephone message and/or a personal telephone call. • O'Carroll et al (2015): Each participant received a simple 'anticipated regret' questionnaire-based manipulation, sent with the standard screening invite.
	Group or Mixed delivery	The intervention was delivered to more than one person at a time or the intervention included both aspects that were delivered on an individual basis and aspects that were delivered in a group.	• Braun et al (2005): Participants took part in a group educational session with the number of people per group ranging between five and 50. • Holt et al (2012): Peer community health advisors in each church led a series of two group education sessions on CRC and screening. • - Maxwell et al (2015): Community health advisors conducted educational group sessions and also distributed print materials and free gFOBT kits.
Intervention provider	Clinically-trained health professionals	Interventions were delivered/led by medically-trained healthcare staff including GPs, nurses, medical assistants, physician assistants, physicians	• Dietrich et al (2013); Medical staff at the Medicaid Managed Care Organisation (MMCO) delivered the intervention. • Boguradzka et al (2013): the intervention was delivered by a primary care practitioner during a routine health visit.
	Non-clinically trained health professionals	Interventions were delivered/led by community/village health workers, health educators, patient navigators, cancer screening community advocates (or any other health worker carrying out functions related to health care delivery and was trained in the context of the intervention but had no formal professional or paraprofessional certificate or degree from tertiary education	• Fiscella et al (2011): The intervention was delivered by a community educator. • Ritvo et al (2015): The intervention was delivered by a trained patient navigator. • Shankleman et al (2014): The intervention was delivered by bilingual, cancer screening community advocates.
	Research staff	Interventions were delivered/led by a	• Aragones et al (2010): The intervention was delivered by

		trained member of a research team or a graduate student.	project research assistants. • Salimzadeh et al (2014): The intervention was delivered by the study research team.
	Person-independent (also known as 'no-contact' interventions)	The intervention was delivered without direct, real-time contact with an interventionist	• Giorgi-Rossi et al (2011): The intervention involved mailing a standard, paper-based invite. • Guiriguet et al (2016): The intervention involved sending an automated reminder. • Schroy et al (2012): The intervention involved sending participants a DVD-formatted decision aid.
Intervention materials	Electronic-based media and electronic-based media plus paper-based media	The intervention was delivered through the use of mobile applications, texting, websites, online videos and/or DVDs etc. A proportion of interventions combined electronic media with print materials.	• Hwang et al (2013): The intervention involved participants interacting with peers in online discussion forums. • Jensen et al (2014): participants were sent either a tailored or untailored web-message and a take-home pamphlet.
	Paper-based media only	The intervention was delivered through the use of printed materials including leaflets, brochures and standard screening invitations.	• Neter et al (2014): Participants received a leaflet containing an 'if-then' condition that arrived with the standard screening invite. • Van Roon et al (2011): Participants received an advanced notification letter two weeks before they were sent the standard screening invite.
	Paper-based media plus phone call	The intervention was delivered through the use of printed materials combined with a phone call(s). The telephone component usually involved providing support to the patient to overcome screening difficulties (e.g., telephone counselling) or was used as a reminder to prompt patients to take part in screening.	• Braun et al (2005): The intervention involved both educational leaflets and a series of telephone calls with patients to address frequently encountered barriers. • Salimzadeh et al (2014): The intervention involved sending participants a print educational booklet and a series of reminder phone calls.
	Phone call only	A telephone was used to facilitate the intervention.	• Basch et al (2006): The intervention involved a series of telephone calls tailored to information provided by the patients during a baseline survey. • Menon et al (2011): The

			intervention compared the effectiveness of two personalised telephone-based interventions - tailored counselling and motivation interviewing – to usual care.
	In person delivery (i.e. Material-independent)	The intervention did not rely on the use of printed materials, electronic media and/or phone calls, rather it relied predominantly on interpersonal interactions between the intervention provider(s) and the intervention recipient(s).	• Boguradzka et al (2014): Participants took part in a one-to-one discussion and received a personal recommendation for screening from a primary care provider. • Dignan et al (2014): The intervention involved the delivery of a series of academic detailing sessions; a method of educating providers, through personal contact, to increase CRC screening recommendations.
	Paper-based media plus in person delivery	The intervention was delivered through the use of printed materials but also involved one or more intervention elements that involved direct contact between the intervention provider(s) and the intervention recipient(s).	• Ling et al (2009): The intervention (groups 2 and 3) involved mailing a standard invitation letter to participants, as well as providing them with patient navigation services. • Maxwell et al (2010): Participants received printed educational materials and participated in group educational sessions. • Potter et al (2011): Participants received printed educational materials as well as a nurse recommendation during a clinic visit.
Setting	Community setting	The intervention was delivered within community-based institutions such as churches, schools, voluntary organisations, neighbourhoods and/or local community health centres.	• Blumenthal et al (2010): The intervention was delivered within community organisations (including churches and clinics) and agencies concerned with promoting cancer screening. • Christie et al (2008): The intervention took place at a non-profit community health centre. • Marcus et al (2005): The intervention was delivered through 14 regional call centres collaborating with the National Cancer Institute. • Percac-Lima et al (2008): The intervention took place in an urban, community health centre.
	Primary or secondary care setting	The intervention was delivered in a primary or secondary care facility; e.g., GP practices, hospitals,	• Clouston et al (2014): The intervention took place in medical, primary care clinics in Manitoba, Canada. • Fortuna et al (2014): The intervention took place in an inner

		primary care clinics.	city, medical practice in New York, USA. • Hewitson et al (2011): The intervention was delivered through GP practices in London, UK. • Levy et al (2013): The intervention was delivered though the Department of Family Medicine and its collaboration with 16 primary care practices in Iowa, USA. • Tinmouth et al (2014): The intervention was conducted in the context of Ontario's CRC screening programme.
Use of Theory	Low or moderate use of theory	Studies that scored 0-2 and 3-5 on the TCS (specifically items 3-11 of the TCS) were considered to demonstrate low and moderate use of theory respectively.	• Hendren et al (2011) reported using the Health Belief Model to develop the intervention. The study scored 4/8 on the TCS (i.e. moderate use of theory). • Potter et al (2011) reported using the General Model of the Determinants of Behavioural Change. The study scored 0/8 on the TCS (i.e. no use of theory). • Ruffin et al (2007) reported using the Elaboration Likelihood Model. The study scored 2/9 on the TCS (i.e. low use of theory).
	High use of theory	Studies that scored 6-8 on the TCS (specifically items 3-11 of the TCS) were considered to demonstrate high use of theory.	• Costanza et al (2007) reported using the Precaution Adoption Process Model to develop the intervention and the study scored 6/8 on the TCS. • Lo et al (2013) developed an intervention based on implementation intentions principles and the study scored 6/8 on the TCS. • Resnicow et al (2014) reported using the Self-Determination Theory to develop the intervention and the study scored 6/8 on the TCS.
Screening Modality	Endoscopic screening modality	These were studies that defined CRC screening using endoscopic procedures (i.e. colonoscopy, flexible sigmoidoscopy), which are diagnostic procedures that involve viewing the bowel internally and if necessary	• Boguradzka et al (2014) defined screening uptake as the participation in colonoscopy within the National Colonoscopy Screening Programme in Poland during follow-up period. • Christie et al (2008) defined screening uptake as the completion of screening colonoscopy during follow-up period. • Jandorf et al (2013) defined

		removing any polyps.	screening as the completion of screening colonoscopy during follow-up period.
	Non-endoscopic screening modality	These were studies that defined CRC screening uptake as using stool-based screening tests (i.e. gFOBT, FIT), which are non-endoscopic and require the collection of small faecal samples, which are then tested for traces of blood.	• Guiriguet et al (2016) defined screening uptake as individuals returning the FIT during follow-up period. • Hagoel et al (2016) defined screening uptake as individuals returning the gFOBT during follow-up period. • Raine et al (2015) defined screening uptake as individuals returning the gFOBT kit during follow-up period.
	Choice to undergo either an endoscopic or non-endoscopic screening procedure	These were studies that defined screening uptake as the participation in either an endoscopic or non-endoscopic CRC screening procedure.	• Gupta et al (2013) defined screening uptakes as completion of either colonoscopy, sigmoidoscopy, gFOBT or barium enema during follow-up period. • Marcus et al (2005) defined screening uptake as completion of either a colonoscopy, flexible sigmoidoscopy or gFOBT.
Use of Reminders	Yes	These were studies that used reminders to improve CRC screening uptake. Reminders included automated or personal telephone calls, postcards, letters, text messages etc.	• Fiscella et al (2011): The intervention involved sending participants two personalised letters, followed up by a phone call reminder. • Hagoel et al (2016): The intervention involved sending participants text-message reminders. • Percac-Lima et al (2008): The intervention involved sending patients reminders as part of a wider patient navigation intervention.
	No	These were studies that did not use reminders (of any form) to improve CRC screening uptake.	• Cohen-Cline et al (2014) tested the effectiveness of a quality improvement intervention that did not include the use of reminders. • Jensen et al (2014) tested the effectiveness of a narrative-based intervention that did not incorporate reminders.
Assessment of outcome	Objective	These were studies that assessed CRC screening uptake using objective methods (e.g., through claims and/or administrative data, patients' electronic medical	• Green et al (2013): Completion of CRC screening was based on evidence from patients' electronic health records or claims data. • Jensen et al (2014): Completion of CRC screening was based on each participants' claims data. • Sequist et al (2011): Completion of CRC screening was based on

		records etc.)	evidence from patients' electronic health records.
	Self-report	These were studies that relied on patients' self-report to assess CRC screening uptake.	• Hwang et al (2013): CRC screening uptake was assessed by self-report. • Pignone et al (2011): The primary outcome was self-reported completion of any CRC screening during follow-up period.
Risk of Bias	High risk of bias	These were studies that failed to meet one or more of the criteria set forth by the Cochrane Risk of Bias tool.	• Dignan et al (2014): Blinding of outcome assessment was considered inadequate. The researchers did not perform and/or report the use of ITT analysis. • Fitzgibbon et al (2007): The randomisation procedure was inadequate (i.e. randomisation occurred at the clinic level and there were only two clinics. Also the researchers did not describe the method they used to randomise clinics). Attrition bias was considered high.
	Unclear risk of bias	These were studies that provided insufficient detail relating to one or more of the criteria of the Cochrane Risk of Bias tool.	• Braun et al (2005): it was unclear whether there was adequate allocation concealment and blinding. • Cole et al (2002): The study did not provide enough detail to decipher whether there was adequate blinding of outcome assessment. • Goldman et al (2015): The study did not provide enough detail to determine whether there was adequate allocation concealment and blinding and whether the researchers conducted ITT analysis.
	Low risk of bias	These were studies that provided sufficient detail across all of the criteria of the Cochrane Risk of Bias tool.	• Fortuna et al (2014) • Gupta et al (2013) • O'Carroll et al (2015)

Appendix 2.6. Overview of BCT Taxonomy (v1) and its 93 hierarchically clustered techniques

Pag	Grouping and BCTs	Pa	Grouping and BCTs	Pa	Grouping and BCTs

e		ge		ge	
1	**1. Goals and planning**	8	**6. Comparison of behaviour**	16	**12. Antecedents**
	1.1. Goal setting (behavior) 1.2. Problem solving 1.3. Goal setting (outcome) 1.4. Action planning 1.5. Review behavior goal(s) 1.6. Discrepancy between current behavior and goal 1.7. Review outcome goal(s) 1.8. Behavioral contract 1.9. Commitment		6.1. Demonstration of the behavior 6.2. Social comparison 6.3. Information about others' approval		12.1. Restructuring the physical environment 12.2. Restructuring the social environment 12.3. Avoidance/reducing exposure to cues for the behavior 12.4. Distraction 12.5. Adding objects to the environment 12.6. Body changes
3		9	**7. Associations**	17	
	2. Feedback and monitoring	10	7.1. Prompts/cues 7.2. Cue signalling reward 7.3. Reduce prompts/cues 7.4. Remove access to the reward 7.5. Remove aversive stimulus 7.6. Satiation 7.7. Exposure 7.8. Associative learning		**13. Identity**
	2.1. Monitoring of behavior by others without feedback 2.2. Feedback on behaviour 2.3. Self-monitoring of behaviour 2.4. Self-monitoring of outcome(s) of behaviour 2.5. Monitoring of outcome(s) of behavior without feedback 2.6. Biofeedback 2.7. Feedback on outcome(s) of behavior		**8. Repetition and substitution**	18	13.1. Identification of self as role model 13.2. Framing/reframing 13.3. Incompatible beliefs 13.4. Valued self-identify 13.5. Identity associated with changed behavior
5		11	8.1. Behavioral practice/rehearsal 8.2. Behavior substitution 8.3. Habit formation 8.4. Habit reversal 8.5. Overcorrection 8.6. Generalisation of target behavior 8.7. Graded tasks		**14. Scheduled consequences**
6			**9. Comparison of outcomes**	19	14.1. Behavior cost 14.2. Punishment 14.3. Remove reward 14.4. Reward approximation 14.5. Rewarding completion 14.6. Situation-specific reward 14.7. Reward incompatible behavior 14.8. Reward alternative behavior 14.9. Reduce reward frequency 14.10. Remove punishment
	3. Social support	12	9.1. Credible source 9.2. Pros and cons 9.3. Comparative imagining of future outcomes		
7	3.1. Social support (unspecified) 3.2. Social support (practical) 3.3. Social support (emotional)		**10. Reward and threat**	19	**15. Self-belief**
	4. Shaping knowledge	15	10.1. Material incentive (behavior) 10.2. Material reward (behavior) 10.3. Non-specific reward 10.4. Social reward 10.5. Social incentive 10.6. Non-specific incentive 10.7. Self-incentive 10.8. Incentive (outcome) 10.9. Self-reward 10.10. Reward (outcome) 10.11. Future punishment		15.1. Verbal persuasion about capability 15.2. Mental rehearsal of successful performance 15.3. Focus on past success 15.4. Self-talk
	4.1. Instruction on how to perform the behavior 4.2. Information about Antecedents 4.3. Re-attribution 4.4. Behavioral experiments				**16. Covert learning**
	5. Natural consequences		**11. Regulation**		16.1. Imaginary punishment 16.2. Imaginary reward 16.3. Vicarious consequences
	5.1. Information about health		11.1. Pharmacological support		

	consequences 5.2. Salience of consequences 5.3. Information about social and environmental consequences 5.4. Monitoring of emotional consequences 5.5. Anticipated regret 5.6. Information about emotional consequences		11.2. Reduce negative emotions 11.3. Conserving mental resources 11.4. Paradoxical instructions		

Appendix 2.7. Characteristics of studies included in the meta-analytic review

Author, Year	Sample	Setting	Study Aims	Study arms	Outcome	Results
Aragones et al, 2010	Latino immigrant population in NYC. Age m (SD) years: 58.9 (7.05)	Primary care clinic of a large NYC teaching hospital (USA)	To assess the effectiveness of a culturally and linguistically sensitive, multilevel intervention, involving patients and physicians, to improve the rate of CRC screening among Latino immigrants	Control group: usual care (N physicians/patients= 31/31) Intervention group: 1) Spanish language CRC educational video providing information about CRC screening modalities, prevention and risk factors 2) A brochure in Spanish summarizing key information from the video 3) One-page reminder to give to their physicians notifying that the patients are eligible for CRC screening and that they received CRC education (N physicians/patients = 34/34)	Any screening test within 6 months	Overall screening rates for the intervention vs. control group was significantly greater: 55% vs. 18% (p = 0.002) Significantly more patients received physician recommendation in the intervention (61%) vs. the control (41%) group (p = 0.08).
Atlas et al, 2014	Patients overdue for breast, cervical and/or CRC screening Age range: Breast: 42-74, Cervical: 21-64 CRC: 52-75 years N (practices/patients): 18/103,870	The Massachusetts General Primary Care Practice-Based Research Network (USA)	To evaluate whether involving primary care providers (PCPs) in a visit-independent population management IT application led to more effective cancer screening	Control practices: Augmented Usual care: overdue patients were automatically sent reminder letters via the automated IT application and transferred to practice delegate lists for follow-up (N practices/patients: 9/52,799) Intervention practices: Augmented usual care plus provider input: PCPs determined whether contact with a patient about screening was needed and how best to provide it (i.e. visit-independent population management): PCPs reviewed real-time rosters of patients overdue for screening and provided individualised contact (via a letter, practice delegate or patient navigator) or deferred screening temporarily/permanently (N practices/patients:	Mammogram, pap smear, any endoscopic CRC screening procedure within 12 months	Adjusted average screening rate did not differ among intervention and comparison practices for all cancers combined (81.6% vs 81.4%; p = 0.84) For CRC: No difference between the groups was observed: 77.8% vs 76.2%; p = 0.33)

				9/51,071)		
Baker et al, 2014	Members of community health centres. Age range: 51-75 years N = 450	Community health centres in Chicago, Illinois. (USA)	To test the effectiveness of a multifaceted intervention designed to address barriers to CRC screening, in a vulnerable population.	Control group: Usual care: Computerised reminders plus gFOBT kit and feedback on screening rates (N = 225). Intervention group: Same as G1, plus mailed reminders, gFOBt kit with low-literacy instructions, return envelope plus Telephone and text message reminders plus Another reminder 2 weeks later if 'no –return' plus Telephone outreach by navigator 3 months later if 'no-return' (N = 225).	gFOBT within 6 months.	Control group: 37.3% completed gFOBT within 6 months. Intervention group: 82.2% completed gFOBT within 6 months. The difference in screening uptake was statistically significant (p <.001).
Barthe et al, 2015	Patients eligible for CRC screening. Age range: 50-74 years N = 3,422	GP practices in Paris. (France)	To assess the impact of a signature from the patient's GP on a letter inviting patients to participate in CRC screening.	Control group: Standard invitation letter and standard reminder (N = 1,527). Intervention group: Standard letter signed by GP inviting patients to visit the GP's office to obtain gFOBT test (N = 1,895).	gFOBT within 6 months.	Screening rates were 14.8% in the intervention group and 14.6% in the control group. There was no statistical difference between the 2 groups (OR = 1.04, 95%, CI: 0.83-1.31; p = 0.731).
Basch et al., 2006	Members of a New York health benefit fund that includes CRC screening coverage Age range: 52-79 years N = 456	New York City metropolitan area. (USA)	To test the effectiveness of a telephone outreach approach versus a direct mail approach in a predominantly African-American population.	Control group: Mailed package that included a letter plus brochure about CRC screening (N = 230). Intervention group: Tailored telephone outreach by a health educator through repeated calls (median = 5) to educate patients on the need for screening and build their self-efficacy in obtaining screening (N = 226).	gFOBT, sigmoidoscopy, colonoscopy or barium enema within 6 months.	Control group: 6.1% (n = 14). Intervention group: 27% received any CRC test (n = 61). Rate difference = 20.9%; 95% CI, 14.34–27.46. RR (Relative risk) 4.4 (2.6–7.7).
Blumenthal et al., 2010	African American population in Atlanta, Georgia.	Various community sites in Atlanta, Georgia including	To assess the efficacy of three separate interventions for increasing CRC screening rates	Control group: educational pamphlet outlining key information on CRC (N = 88). G1: Financial support intervention: participants were offered financial reimbursement for covering CRC out of pocket expenses including transportation and other nonmedical expenses (N	Any CRC screening within 6 months.	Screening rates were significantly higher in G3 when compared to the control group (33.9% vs. 17.7%; p = 0.039). Rate difference: 16.2%

	Age range: 50-74 years N = 369	churches, community centres or clinics. (USA)	among African Americans.	= 84). G2: One-on-one education: health educators reviewed educational materials with patients and engaged in one-on-one discussion about CRC risk and screening (N = 98). G3: Group education: Health educators met with participants in groups to review similar educational materials to G2 (N = 99).		Screening rates were not significantly higher between G1 (22.2%) and G2 (25.4%) when compared to controls. Rate difference: 4.5% and 7.7% respectively.
Boguradzka et al., 2014	Patients eligible for CRC screening. Age range: 50-65 years N = 600	A group physician practice of four primary care physicians (PCPs) in the urban areas of Warsaw. (Poland)	To compare the effect of PCP counselling vs. a CRC information leaflet, on participation screening rates in a primary colonoscopy screening program.	Control group: PCP prompted patients to obtain a CRC information leaflet after a scheduled health visit (N = 300). Intervention group: PCP directly recommended screening at the end of health visit. Discussion included information about the benefits of CRC screening and early treatment plus recommendation to participate in colonoscopy screening plus information about the procedure plus help with screening arrangements (N = 300).	Colonoscopy within 6 months.	Screening colonoscopy rates were 47% in the intervention group vs. 13.7% in the control group (p<.05). PCP counselling was associated with higher adherence (AOR, 5.33, 95% CI: 3.55 – 8.00, p<.001).
Braun et al., 2005	Native Hawaiians eligible for CRC screening. Age range: >50 years N = 121	Hawaiian civic clubs located in urban and rural areas of Hawaii. (Hawaii)	To test the effectiveness of an intervention based on social learning theory (SLT) on improving CRC screening among Native Hawaiians.	Control group: patients received a culturally targeted educational presentation on CRC screening, a free gFOBT kit and a reminder call (N = 52). Intervention group: patients received a culturally targeted educational intervention based on SLT principles delivered by a Hawaiian CRC survivor plus an gFOBT demo plus multiple telephone calls to address barriers (N = 69).	gFOBT within $2^{1/2}$ months.	The intervention group was less likely to be screened post-intervention compared to the control group (OR = 0.364, 95% CI: 0.14-0.97). Results indicated that an SLT-based intervention, contrary to expectations, was less effective than the culturally targeted educational session.
Braun et al., 2015	488 Medicare beneficiaries.	General hospital Hawaii.	To assess whether the use of patient navigators reduced	Control group (N = 246): Received cancer education. Intervention group (N = 242): Received navigation	Any CRC screening within 12	Screening rates were 43% in the intervention group and 27.2% in the control group

	Age range: 60-75 N = 488		racial disparities in relation to breast, cervical, prostate and CRC screening uptake.	services to help them access cancer screening services.	months.	for flexi sig and /or colonoscopy screening uptake.
Cameron et al., 2011	Patients with an expired order of colonoscopy. Age range: 50-79 years N = 628	Urban academic adult primary care internal medicine practice in Chicago, Illinois. (USA)	To test the efficacy of a multicomponent intervention to increase CRC screening among patients who received and accepted referral for colonoscopy but did not attend within 3 months.	Control group: usual care: a reminder letter at 6 months (N = 314). Intervention group: personalised reminder letter plus educational brochure plus DVD about CRC and screening based on the Extended Parallel Process Model of health behaviour to address CRC screening barriers (N = 314).	gFOBT, FS or colonoscopy within 6 months.	At 6 months 18.2% in the intervention group and 12.1% in the control group had completed CRC screening. Absolute difference of 6.1% (rate ratio, 1.5, 95% CI: 1.03-2.2, *p* = 0.03)
Christie et al., 2008	Low-income minorities eligible for screening colonoscopy. Age range: >50 years N = 21	Local community health centre, NYC. (USA)	To determine whether a patient navigator (PN) can increase patient compliance with CRC screening colonoscopy, among a low-income minority population.	Control group: PN- : usual care (N = 8). Intervention group: PN+: the PN assisted in patient education on CRC risks and prevention plus answered questions about colonoscopy preparation plus provided reminders plus bilingual explanations on procedures plus assisted with organising appointments and transportation (N = 13).	Colonoscopy at 6 months.	53.8% of the intervention group completed screening colonoscopy vs. 13% of control group (*p* = 0.058). Absolute increase: 40.8%
Church et al., 2004	Residents, 50 years of age or older. Age (m/SD): 63 years (10.2) N = 1,255	Wright County, a non-urban county in Minnesota. (USA)	To test direct mailing of gFOBT kit with and without reminders to general population.	Control group: Questionnaire only (n = 417). G1: Direct mail without reminders group: Questionnaire mailed plus gFOBT kit and instructional brochure (N = 434). G2: Direct mail with reminders group: Same package as G2, plus telephone reminders (N = 404).	gFOBT at 12 months.	Control group: 1.5% gFOBT completion rate (95% CI: −2.9–5.9%); 7.8% for any CRC test (95% CI: 3.2–12.0%) G1: No reminders group: 16.9% gFOBT completion rate (95% CI: 11.5–22.3%); 13.2% for any CRC test (95% CI: 8.4–18.2%). G2: Reminders group: 23.2% gFOBT completion rate (95% CI:

						17.2–29.3%); 14.1% for any CRC test (95% CI: 9.1–19.1%).
Clouston et al., 2014	Family physicians (FPs) and their patients eligible for CRC screening. Age range: 50-70 years N clinics/patients/physicians = 39/2,395/70	Medical, primary care clinics in Winnipeg, Manitoba, Canada. (Canada)	To evaluate whether a patient decision aid distributed to patients by their family physician will improve gFOBT screening rates.	Control group: received usual care (N = 1,174). Intervention group: FPs gave their patients a patient decision aid in the form of a refrigerator magnet, which directed patients to accessing CRC information and a screening nurse managed support line and website (N = 1,221).	gFOBT within 4 months.	Patients in the intervention group had significantly higher gFOBT completion rates (66.6%; OR 1.47, 95% CI: 1.06-2.03, *p* <0.02) compared to controls (56.9%). Absolute difference: 9.7%.
Cohen-Cline et al., 2014	Patients due for CRC. Age range: 50-81 years N = 13,279	Managed care organisation in Washington State. (USA)	To assess whether an interactive voice response (IVR) system could be effective to engage people in CRC screening.	Control group: Usual care: a personalised outreach letter informing patients on screening (N = 3,279). Intervention group: A single IVR telephone call including: assessment of prior CRC screening plus information about the benefits of screening and elicitation of barriers plus offer of a gFOBT kit mailed at home (N = 10,000).	Any CRC screening at 6 and 12 months.	6-month follow-up: Adherence to CRC screening was 10% in the intervention group vs. 7.8% in the control group (HR, 1.32, 95% CI: 1.14-1.52, p<0.001) (sample N = 13,279). 12-month follow-up: CRC uptake was 16.6% in the intervention group vs 14.1% in the control group (HR, 1.20, 95% CI: 1.08, 1.34, p<0.001) (sample N = 11, 010).
Cole et al., 2002	South Australian residents, eligible for CRC screening. Age range: >50 years	South Australian residents from 2 sources: 1) Patient lists of	To assess the influence of GP endorsement on participation in screening for CRC by gFOBT.	Control group: Usual care (N = 600). G1: Treatment arm 1: Invitation with no indication that their GP was involved (N = 600). G2: Treatment arm 2: received invitation indicating support from the practice (N = 600). G3: Treatment arm 3: received invitation on practice letterhead and signed by practice partner	gFOBT at 3 months.	CRC participation rates for G2 (38%) and G3 (40.7%) were significantly higher than the control group/G1 (32%) (OR, 0.77; 95% CI: 0.60-0.98).

	N = 2,400	primary care practices 2) Electoral roll (ER) of the Australian Electoral Commission		plus CRC information sheet plus gFOBT kit (N = 600).		Absolute difference: 6% between G2 and control/G1 and 8.7% for G3 and control/G1.
Cole et al., 2007	Patients eligible for CRC screening. Age range: 50-74 years (N = 2,400)	Community screening program in Adelaide. (Australia)	To determine the impact of three novel letter-based invitation strategies on population participation in CRC screening by FIT.	Control group: usual care: standard invitation letter explaining risk of CRC and value of screening (N = 600). G1: Intervention arm 1: Risk Group: Standard invitation plus additional positively framed messages about CRC risk, generalised for CRC risk and relative risk for CRC (N = 600). G2: Intervention arm 2: Advocacy Group: invitation with additional messages related to advocacy for screening from previous screening program participants (N = 600). G3: Intervention arm 3: Advanced notification group: a letter introducing standard invitation messages followed by the standard invitation 2 weeks later (N = 600). FIT kits were sent to all groups	FIT at 3 months.	CRC screening uptake was significantly greater in G3 (48.3%) compared to Controls (39.5%) (RR, 1.23, 95% CI: 1.06-1.43, *p*<.05). No significant differences in uptake were observed between G1, G2 and the control group.
Coronado et al., 2011	Hispanic patients eligible for CRC screening. Age range: 50-79 years N = 501	Seattle community clinic. (USA)	To evaluate whether a clinic-based intervention would improve CRC screening rates among a Hispanic population.	Control group: received usual care (N = 165). G1: Mailed gFOBT only: mailed kit plus instruction in English and Spanish (N = 168). G2: Mailed gFOBT plus outreach: mailed kits and instructions, telephone reminders and home visits (N = 168).	gFOBT at 9 months.	Compared to the control group (2%) screening uptake rates were significantly higher (p<.001) for both G1 (26%) and G2 (31%). Absolute difference: 24% and 29% for G1 and G2 respectively.
Costanza	Patients eligible	Community	To assess the	Control group: Usual care (N = 1,261).	gFOBT, FS	There was no significant

et al., 2007	for CRC screening. Age range: 50-75 years N = 2,448	primary care practices (PCPs) in Massachusetts. (USA)	effectiveness of a computer-assisted tailored telephone counselling intervention on increasing CRC screening.	Intervention group: patients received a mailed booklet on CRC screening followed by computer-assisted telephone counselling that was based on the Precaution Adoption Process Model (N = 1,187).	or colonoscopy at 2 years.	difference in screening rates between the control (19%) and intervention group (20%) on either of the screening methods (p = 0.68).
Denberg et al., 2005	Adults due for colonoscopy. Age range: >50 years N = 781	2 general internal medicine practices in Denver, Colorado. (USA)	To test whether a brochure sent to patients' homes, after referral for colonoscopy, will increase screening rates by colonoscopy.	Control group: Received usual care (N = 395). Intervention group: an educational brochure encourage patients to schedule a colonoscopy, discussing cancer prevention and early detection, providing facts about CRC and polyps, description of colonoscopy procedure and alternative screening tests (N = 386).	Colonoscopy at 4 months.	The intervention group had significantly higher rates of colonoscopy (70.7%) at 4 months post intervention compared to the control group (59%) resulting in an 11.7% higher screening rate (95% CI: 5.1% to 18.4%; p<.001).
Dietrich et al., 2006	Females overdue for at least 1 cancer screening (out of breast, cervical and bowel cancer). Age range: 50-69 years N = 1,413	11 community and migrant health centres in NYC. (USA)	To evaluate the effect of a telephone support intervention to increase rates of breast, cervical and CRC screening among minority and low-income women.	Control group: received usual care (N = 694). Intervention group: received an average of 4 tailored telephone reminder calls from prevention care managers who aimed at facilitating all aspects of the screening process and addressed barriers (N = 696).	Any at 18 months.	Women in the intervention group had significantly higher CRC screening rates compared to those in the control group; 63% vs. 50%, p = 0.075 Overall significantly more women in the intervention group were up to date for all 3 forms of screening compared to controls (p<0.001)
Dietrich et al., 2007	Females overdue for at least 1 cancer screening (out of breast, cervical and	6 Community health centres in NYC.	To assess the impact of prevention care management (PCM) delivered through a Medicaid	Control group: women in this group received a modified version of the MMCO's established mammography telephone outreach program and received up to 3 scripted phone calls plus educational brochures on all 3 cancers (N = 663).	Any CRC screening at 10 months.	Women in the intervention group (32%) were 1.69 times more likely to be up to date for CRC screening compared to control women (25%) (95% CI: 1.03-2.77, p =

	bowel cancer). Age range: 50-69 years N = 1,316	(USA)	managed care organisation (MMCO) on breast, cervical and CRC screening among women attending Community Health Centres.	Intervention group: women in this group received the PCM intervention; 3 scripted phone calls to identify barriers and provide support to obtain any needed breast, cervical and CRC screening tests (N = 653).		0.04). Absolute difference: 7% For breast and cervical cancer rates did not differ significantly.
Dietrich et al., 2013	Females with Medicaid insurance in New York City. Age range: 50-63 years N = 2,240	Medicaid Community Health Centres in New York City. (USA)	To test the effectiveness of a telephone outreach intervention versus usual care to increase CRC screening rates, among publicly insured women (Medicaid).	Control group: usual care: standard telephone screening invite (N = 1,678). Intervention group: mailing of a personalised letter, screening recommendation from physician, scripted telephone outreach up to 12 times to address barriers, provision of reminders until patients were up to date with screening (N = 562).	gFOBT, FS, colonoscopy or barium enema at 18 months.	Control group: 30.6% CRC screening completion rate Intervention group: 36.7% CRC screening completion rate (AOR, 1.32, 95% CI: 1.08-1.62, p< 0.01) Although screening rates in the intervention vs. control group were higher, the overall increase was driven by 1 clinic alone (Clinic 2; AOR, 1.98; 95% CI: 1.39-2.82, p< 0.001).
Dignan et al., 2014	Primary care practices (PCPs) and their patients. Age range: 50-75 years N (PCPs) = 66 N (patients = 3,844)	Primary care practices in Appalachian Kentucky. (USA)	To assess whether an academic detailing intervention that reaches rural primary care providers is effective in increasing CRC screening rates in rural Kentucky.	Control group practices: received delayed intervention (N = 33 PCPs/1,842 patients). Intervention group practices: received an academic detailing intervention; a method of education where providers receive information, here specific to CRC, through personal contact (N = 33 PCPs/ 1,909 patients).	Any CRC screening at 6 months.	No intervention effect was found for gFOBT uptake. For intervention group practices colonoscopy screening rates increased by 15.7% at 6 months compared to an increase of 2.4% in control group practices (conditional on provider recommendation, p = 0.01). Absolute difference: 13.3%
Ferreira et al., 2005	Male veterans due for CRC screening.	Two general medicine	To assess whether an educational, quality-	Control group: received usual care (N = 963). Intervention group: health care providers	gFOBT, FS and colonoscop	Screening tests were completed by 41.3% of patients in the intervention

	Age range: >50 years N = 1,978	primary care outpatient firms at a Veteran Affairs (VA) Medical Centre in Chicago, Illinois. (USA)	improvement workshop, directed to the healthcare provider, is effective in increasing CRC screening rates.	attended a workshop on CRC screening plus every 4 to 6 months they attended quality improvement workshops where they received group screening rates, individual confidential feedback plus training on improving communication with patients with limited literacy skills (N = 1,015).	y at 18 months.	group vs 32.4% in the control group (p = 0.003) (absolute difference: 8.9%) Among patients with health literacy skill less than 10th grade, screening was completed by 55.7% of patients in G2 vs. 30% in G1 (p<0.01) (absolute difference: 25.7%).
Fiscella et al., 2011	Patients overdue for a mammography or CRC screening in New York City. Age range: 50-74 years N = 326	An inner city, family, medicine practice in New York. (USA)	To examine the effectiveness of a multimodal, screening promotion intervention on mammography and CRC screening rates, among a low-income and ethnic minority group.	Control group: received usual care (N = 163). Intervention group: received mailed personalised educational letters and phone call from patient navigator highlighting the importance of screening and that they were overdue plus mailing of gFOBT kit (if insured) plus prompts and medical assistants at point of care (N = 163).	Mammography (breast cancer) Any CRC screening at 1 year (CRC cancer)	Reporting CRC screening rates only: Control group: 10% CRC screening completion rate Intervention group: 28.8% CRC screening completion rates (AOR, 3.69; 95% CI, 1.93-7.08) *P* value not reported.
Fitzgibbon et al., 2007	Noncompliant male veterans. Age range: >50 years N = 986	2 primary care clinics in a Veteran Affairs (VA) medical centre in Chicago, Illinois. (USA)	To assess whether a combined provider/patient trial would improve: 1) recommendation rates by primary care providers (PCPs) and 2) CRC screening completion rates by patients.	Control group: received usual care (N = 728). Intervention group: Received: 1) A provider intervention: providers attended training sessions on CRC and on communicating health messages about CRC to patients effectively 2) A patient intervention: patients received educational materials on CRC based on the Health Belief Model to address perceived barriers and severity of CRC and to improve self-efficacy plus simplified gFOBT instructions (N = 258).	Any CRC screening at 2 years.	Intervention patients were not more likely to complete any CRC screening compared to G1 (p = 0.61); 41.6% vs. 39.5% in G1 and G2 respectively. Patients of providers who attended the intervention sessions were more likely to be screened (42% vs. 29%, p<0.05).

Ford et al., 2006	African American (AA) males eligible for CRC screening. Age range: >55 years N = 703	The Henry Ford Health System, Cancer Screening Trial site in Detroit, Michigan. (USA)	To test the efficacy of a case management strategy in promoting cancer screening among older AA men (prostate, lung and CRC cancer).	Control group: received usual care (N = 351). Intervention group: Case managers contacted participants monthly and address CRC screening barriers, provided information on all aspects of screening procedures and provided referral services (N = 352).	FS, Prostate Specific Antigen Test, chest x-ray at 3 years.	There were no statistically significant differences between the intervention and control groups regarding CRC screening adherence; 61.3% vs. 56.9% respectively.
Fortuna et al., 2014	Men due for CRC screening and women due for CRC and breast cancer (BC) screening Age range: males: 50-74 years, females: 40-74 years N = 629	Urban, internal medicine practice in NYC serving a large black and Hispanic, low-income population. (USA)	To assess the relative and incremental impact of various components of the reminder, recall and outreach (RRO) model on BC and CRC screening rates within a safety net practice.	Active control: received reminder letter (N = 157). G1: Same as active controls plus automated telephone message (N = 158). G2: Same as G1 plus point of service prompt (N = 156). G3: Reminder letter plus personal telephone call (N = 153).	Any CRC screening, mammography for BC at 13 months.	G3 had significantly higher CRC screening rates compared to active controls (12.2% vs. 21.5%; AOR, 2.0, 95% CI: 1.1-3.9). G2 had significantly higher CRC screening rates compared to active controls (12.2% vs. 19.6%; AOR, 1.9, 95% CI: 1.0-3.7). Active controls and G1 were not significantly different.
Ganz et al., 2005	Provider Organisations (POs) and their patients Age range: >52 years N (POs) = 36 N (patients) = 1,850	A large network model health maintenance organisation (HMO) that contracted with POs throughout	The aim was to assess whether a quality improvement (QI) program would increase CRC screening in a managed health care plan at the provider organisation (PO) level.	Control group: received usual care. (N POs/patients = 17/930). Intervention group: POs received a QI program consisting of: educational sessions and materials on CRC, a medical director in each PO having the role of a facilitator, assistance with chart audit and organisational strategy, ongoing consultation aand organisational academic detailing focusing on the facilitator and the medical director. (N POs/patients = 19/920).	gFOBT, FS and colonoscopy at 2 years	There was no difference in uptake between intervention and control POs (28% vs. 30.6% respectively, *p* = 0.22).

		California (USA)				
Gimeno-Garcia et al., 2009	Patients eligible for CRC screening Age range: 50-79 years N = 158	Medical practice, Tenerife (Spain)	To evaluate whether an educational video would improve patient knowledge and compliance with CRC screening	Control group: viewed a neutral, non-medical video plus free gFOBT kit (N = 79). Intervention group: viewed a brief video on CRC risk, prognosis, main symptoms and screening procedures plus free gFOBT kit (N = 79).	gFOBT at 2 weeks.	Rate of gFOBT return showed a two-fold increase in the intervention group compared to the control group (69.6% vs. 54.4%; *p* = 0.35), OR, 2.0; 95% CI: 1.02-3.84, *p* = 0.044).
Rossi et al. (2011)	Patients eligible for CRC screening. Age range: 50-70 years N previous responders: 3,196 and N non-responders: 4,219 N total = 7,415	4 screening programs in Italy. (Italy)	To assess whether direct mailing of gFOBT kits (both to people who had previously participated in screening and non-responders) is effective in increasing screening participation.	RCT 1: Responders in the previous round *(not included in meta-analysis)* G1: Control group: obtain gFOBT kit at the clinic (N = 1,600). G2: Intervention group: direct mailing of gFOBT kit (N = 1,596). RCT 2: Non-responders to previous invitation *(included in meta-analysis)* G1: Control group: standard recall letter to obtain gFOBT kit at the clinic (N = 2,112). G2: Intervention group: direct mailing of the gFOBT kit (N = 2,107.	gFOBT at 3 months.	In both trials participation was higher with direct mailing of gFOBT kits: For previous responders: RR 1.11 (95% CI: 1.06-1.17). For non-responders: RR 1.46 (95% CI: 1.16-1.60).
Goldberg et al., 2004	A predominantly low-income, African American population Age range: 50-80 N = 139	Urban, public hospital in Boston. (USA)	To assess whether mailing gFOBT kits timed to coincide with patients' primary care appointments would improve screening uptake.	Control group: Usual care (N = 60). Intervention group: patients in this group were linked to a system of mailing an gFOBT kit and mailed reminder 2 weeks prior to a scheduled appointment with their physician – that is, to coincide with the appropriate time to begin the diet suggested in preparation for gFOBT) (N = 59).	gFOBT at 12 months.	Screening uptake at 1-year follow-up was 40.7% for the intervention group vs. 5% for the control group (OR, 13.0; 95% CI: 3.6-45.5, p<0.001).
Goldman et al., 2015	Patients with no CRC screening	A health centre	To determine the effect of a	Control group: received usual care (N = 210).	FIT at 6 months.	Patients who received the intervention were more likely

	history. Age range: 50-74 N = 420	network based in Chicago. (USA)	multifaceted outreach intervention to increase CRC screening uptake among patients who had not completed screening previously.	Intervention group: received screening outreach including FIT kits mailed to their homes, automated phone calls and text messages (N = 210).		to complete FIT that those in the control group (36.7% vs 14.8%, p<0.001 at 6 months, 40% vs 22.4% at 12 months).
Green et al., 2013	Patients overdue for CRC screening. Age range: 50-73 years N = 4,675	21 primary care medical centres of a non-profit healthcare delivery system. (USA)	To determine whether an intervention using Electronic Health Records (EHRs), automated mailings and stepped increases in support improve CRC screening adherence.	Control group: received usual care (N = 1,167). G1: Automated intervention arm: received usual care plus EHR-linked mailings system, which tracked when screening was due and sent automated reminder mailings (N = 1,173). G2: Assisted intervention arm: same as G2 plus telephone assistance from a medical assistant who determined patients' intent and reviewed educational materials to facilitate a screening decision (N = 1,161). G3: Navigated intervention arm: same as G3 plus nurse navigation to assist patients at all stages of the screening process (1,174).	Any CRC screening at 2 years.	Screening rates were 26.3%, 50.8%, 57.5% and 64.7% for controls, G1, G2 and G3 respectively. All 3 intervention groups were more likely to obtain screening compared to controls, with significant increase by intensity. Absolute difference from control group: 24.5%, 31.2%, 38.4% for G1, G2 and G3 respectively (*p*<0.001 for all pair-wise comparisons)
Green et al., 2016	Patients overdue for CRC screening. Age range: 50-73 years N = 2,208	21 primary care clinics. (USA)	To determine the effect of continuing a centralised gFOBT mailing program on screening adherence.	Control group: the Stopped group in which interventions were stopped (N = 1,102). Intervention group: the Continue group which received mailed information regarding CRC screening choices, and were mailed stool kit tests (N = 1,106).	Any CRC screening at 6 and 12 months.	CRC screening uptake was significantly higher in patients in the intervention group compared to the control group (53.3% vs. 37.3%; adjusted net difference, 15.6%, *p*<0.001).
Guiriguet	Patients eligible	Primary	To evaluate the	Control group: received usual care (N = 63	FIT at 12	Screening participation was

et al., 2016	for bowel cancer screening. Age range: 50-69 years N = 130 physicians, 41,042 patients	care centres in Barcelona. (Spain)	effectiveness of an alert in primary care electronic medical records (EMRs) to increase CRC screening uptake.	physicians, N = 19,423 patients). Intervention group: received usual care plus an alert to health professionals was incorporated in patients' primary care EMRs (N = 67 physicians, N = 21,619 patients).	months.	44.1% and 42.2% in the control and intervention group respectively (OR, 1.08, 95% CI: 0.97 – 1.20, *p*>0.05).
Gupta et al., 2013	Uninsured participants, not up-to-date with CRC screening. Age range: 54-64 years N = 5,994	A safety net health system in Texas. (USA)	1) To assess whether an organised mailed outreach improves CRC screening rates. 2) Whether FIT is superior to colonoscopy in increasing screening rates.	Control group: received usual care, which offered opportunistically (i.e. was visit-based) (N = 3,914). G1: FIT outreach group: patients received a mailed invitation plus free FIT kit plus a telephone follow-up (N = 1,600). G2: Colonoscopy outreach group: same as G2 but were offered the choice of a free colonoscopy instead of FIT (N = 480).	Any CRC screening at 12 months.	Screening was significantly higher for both FIT (40.7%) and colonoscopy outreach (24.6%) compared to control group (12.1%); *p*<0.001 for both comparisons with usual care.
Hagoel et al., 2016	Patients eligible for bowel cancer screening. Age range: 50-74 years N = 48, 091	National Israeli bowel cancer screening programme. (Israel)	To examine the applicability and effectiveness of a Question-Behaviour Effect (QBE) intervention by comparing 4 versions of a text message.	Control group: received usual care (N = 9,602) G1: Interrogative reminders with reference to social context (N = 9,596). G2: Interrogative reminders without reference to social context (N = 9,631). G3: Non-interrogative reminders with reference to social context (N = 9,632). G4: Non-interrogative reminders without reference to social context (N = 9,630).	gFOBT at 6 months.	Screening participation was significantly higher for Gs 1, 2 and 3 when compared to controls. Screening rates for the control group and Gs 1, 2, 3 and 4 were 8.5%, 10.3%, 9.8%, 9.6% and 9.2% respectively. The highest gFOBT rates were achieved in the interrogative –reminder groups (i.e. Gs 1 and 2) than in the other 3 groups (OR 1.11, 95% CI: 1.05 – 1.19).
Hendren et al., 2014	Patients overdue for mammography	Inner city, safety-net primary	To assess the efficacy of a multimodal	Control group: received usual care (N = 181). Intervention group: patients received personalised	Mammography for BC at 12	CRC screening uptake was significantly higher in intervention vs the control

	and CRC screening. Age range: 40-74 years N = 366	care family practice in NYC. (USA)	intervention to increase mammography and CRC screening.	invitation letters, automated phone call messages, a free FIT kit and a point of care prompt to complete screening (N = 185).	months. Any CRC screening at 12 months.	group: 37.7% vs. 16.7% (AOR, 3.22, 95% CI: 1.65-6.30, *p* =0.0002). Mammography: significantly higher screening rates in the intervention vs the control group: 29.7% vs. 16.7%, (*p* = 0.034).
Hewitson et al., 2011	Patients eligible for CRC registered with a general practitioner (GP). Age range: 60-75 years N = 1,288	Letters sent out from GP practices in the Southern Programme Hub, in southern England. (UK)	To investigate whether a GP's letter encouraging participation and a more explicit leaflet explaining how to complete gFOBT improves uptake.	Control group: received usual care: standard invitation (N = 322). G1: Personalised letter only: letters were personalised to patients and included key health messages phrase using a 'gain-frame' approach (N = 322). G2: Leaflet only: it addressed multiple barriers and aimed at enhancing CRC knowledge and improve self-efficacy (N = 322). G2: GP Letter plus Leaflet: received both the interventions (N = 322).	gFOBT at 5 months	Compared to the control (49.4%), patients in G1 (55%) had significantly higher screening rates (OR 1.26; 95% CI: 1.01-1.58, *p* = 0.038). Compared to Controls (49.4%) patients in G2 (55.3%) had significantly higher screening rates (OR 1.28; 95% CI: 1.03-1.59, *p* = 0.029). Compared to Controls (49.4%), patients in G3 (61.2%) were significantly more likely to undergo screening (*p*<.05).
Holt et al., 2012	Church-going, African Americans (AAs). Age range: 50-74 years N = 285	16 African American churches in Alabama. (USA)	To assess the effectiveness of a spiritually based intervention in increasing CRC screening among AAs in church settings.	Control group: non-spiritual comparison group: participants received educational sessions on CRC and screening but no spiritually-oriented materials were involved (N churches = 8, N participants = 133). Intervention group: spiritually based intervention: participants received educational sessions regarding CRC (i.e. risk, symptoms, prevention	Any CRC screening at 12 months.	Screening uptake was 42.1% in the control group vs. 41.4% in the intervention group (*p*>.05)

				and screening) and the content included scripture and spiritual themes relevant to the AA culture. Materials were based on the Health Belief Model (N churches = 8, N participants = 152).		
Horne et al., 2015	Medicare patients aged 65 or older. N = 1,220	Clinical settings and community based venues.	To investigate the effect of patient navigation in increasing CRC screening among older African Americans.	Control group: received printed educational materials (PEM) only (N = 642). Intervention group: received patient navigation services in addition to PEM (N = 578).	Any CRC screening.	Compared with controls, the intervention group was more likely to report being up-to-date with CRC at the exit interview (OR 1.55, 95% CI: 1.07 – 2.23). PN was effective in increasing screening for endoscopy/colonoscopy but not for gFOBT.
Hwang et al., 2013	Members of an online weight loss community. Age range: > 50 years N = 306	Online weight-loss community website. (USA)	To assess whether narratives and peer support online increases CRC screening rates.	Control group: Basic group: participants viewed general educational information about CRC (N = 153). Intervention group: Enhanced group: same as the control group but also had access to narratives and peer support pages for CRC screening in online forums plus were offered Amazon gift cards (N = 153).	Any CRC screening at 6 months.	There was no difference in CRC uptake at 6 months between the intervention and control group (16.3% vs 18.9% respectively, AOR 1.33, 95% CI: 0.73, 2.42).
Inadomi et al., 2012	Participants eligible for CRC screening. Age range: 50-79 years N = 997	Public health care system of the City and County of San Francisco. (USA)	To determine whether the approach by which screening is recommended influences adherence.	G1: gFOBT arm: patients received a recommendation to screen by gFOBT from physician (N = 344). G2: Colonoscopy arm: patients received a recommendation to screen by colonoscopy from physician (N = 332). G3: Choice arm: patients were offered to choose between gFOBT or colonoscopy screening (N = 321).	gFOBT, colonoscopy at 12 months.	Participants in G2 completed screening at a significantly lower rate (38%) than participants who were recommended gFOBT (67%) (p<0.001) or given a choice between gFOBT or colonoscopy (69%) (p<.001).
Jandorf et al., 2013	African American (AA) patients overdue for CRC	Primary care clinic in NYC.	To assess the effectiveness of 3 patient navigation (PN) formats in	Active control: Standard Navigation Group: received 5 phone calls intermittently before scheduled colonoscopy and information on CRC screening plus specific instructions for	Colonoscopy at 2 weeks.	No significant differences were shown in screening colonoscopy completion rates in the 3 arms (G1 74%,

	screening. Age range: >50 years N = 350	(USA)	increasing screening colonoscopy among an AA population.	colonoscopy (N = 46). G1: Peer-patient Navigation Group: same as active control plus PN assistance delivered by community members who discussed personal experiences, promoted culturally targeted health messages, addressed concerns and assisted with screening arrangements (N = 181). G2: Pro-patient Navigation Group: same as G1 but delivered by healthcare professionals (N = 123).		G2 76.4% and active control 80.4%, *p*>.05).
Jean-Jacques et al., 2012	Patients overdue for CRC screening. Age range: 50-80 years N = 202	Community health centres serving primarily a low-income, ethnically-diverse population in Chicago, Illinois. (USA)	To assess whether the direct mailing of gFOBT kits would improve screening rates among a poor, racially and linguistically diverse, population.	Control group: received usual care (N = 98). Intervention group: received mailed package including a letter encouraging gFOBT completion, CRC fact sheet, gFOBT kit with instructions plus reminder phone calls from bilingual lay health educators at 2 and 6 weeks (N = 104).	gFOBT, FS or colonoscopy at 4 and 12 months.	Control group: 5% CRC screening completion rate mainly via gFOBT Intervention group: 30% CRC screening completion rate mainly via gFOBT The difference between the groups was statistically significant at 4 and 12 months (*p*< .001 and *p* = .002 respectively)
Jensen et al., 2014	Healthcare and manufacturing workers, eligible for CRC screening. Age range: 50-75 years N = 288	8 worksites in Indiana. (USA)	To assess and compare the effect of 2 interventions; tailoring and narrative based approaches in increasing CRC screening adherence.	Control Group: Stock: no narrative, no tailoring: a pamphlet involving information on CRC and screening options (N = 72). G1: Intervention Arm 1: Narrative: Narrative, no tailoring: same as G1 but CRC screening information was delivered through a story (N = 72). G2: Intervention Arm 2: Tailored: Tailoring, no narrative: CRC and screening information was personalised to the patients based on baseline	Any CRC screening at 18 months.	Screening uptake was 4.1%, 11.1%, 6.9% and 18% for the control group, G1, G2 and G3 respectively. Groups receiving the narrative-based approach were 4 times more likely to screen than those not receiving narrative messages.

				information (N = 72). G3: Intervention Arm 3: Tailored Narrative: Tailoring plus Narrative (N = 72).		
Katz et al., 2011	Patients eligible for CRC screening. Age range: >50 years N = 270	Health Centre serving a mostly minority and low SES population in Ohio. (USA)	To determine whether a patient activation intervention improved CRC screening rates among low-income minority patients.	Control group: viewed an educational video on CRC screening information (N = 132). Intervention group: same as G1 plus patient activation (brochure focusing on tips to prevent CRC) plus telephone barriers counseling (to address patient identified CRC screening barriers) Materials were based on the Protection Motivation Theory principles (N = 138).	Any CRC screening at 2 months.	Significantly more patients in the intervention group completed CRC screening compared to controls (19.6% vs. 9.9%); OR 2.35, 95% CI: 1.14-5.56; *p* = 0.020).
Krok-Schoen et al, 2015	Patients eligible for bowel cancer screening. Age range: 51-75 years N = 1,091	The clinical component of the intervention was set within primary care clinics and the media component was set within the wider community. (USA)	To implement and evaluate a county-level intervention consisting of media and clinic-level components to increase CRC screening in Ohio Appalachian residents.	Control group: received a media campaign and clinic intervention focused on healthy eating (N = 525). Intervention group: received a media campaign and clinic intervention focused on CRC screening (N = 566).	Any CRC screening (unclear follow-up).	There was not a statistically significant difference in screening uptake between the control (31.4%) and intervention (35.2%) group.
Lasser et al., 2011	Patients overdue for CRC screening and spoke	A primary care, practice-based, research	To test the effectiveness of a patient navigation-based intervention	G1: Control group: received usual care (N = 230). G2: Intervention group: Telephone communication between navigators and patients to provide CRC	Any method but mainly gFOBT or	CRC screening uptake was significantly higher in the intervention group compared to controls (33.2% vs. 20%;

	English, Haitian, Creole, Portuguese or Spanish as their primary language. Age range = 52-74 years N = 465	network predominantly serving a low-income, multi-cultural population. (USA)	to increase CRC screening rates among predominantly Haitian Creole or Portuguese-speaking patients.	screening education and discuss screening options' pros and cons, patients' barriers and concerns and stage of change. Upon choice of screening method, navigators explained instructions and arranged colonoscopy referrals. Navigators provided emotional support wherever necessary (N = 235).	colonoscopy at 12 months.	*p*< .001). Subgroup analyses indicated the intervention was particularly beneficial for patients whose primary language was not English (39.8% vs. 18.6%; *p*< .001) and for Black patients (39.7% vs. 16.7%; *p* = .004).
Lee et al., 2009	U.S. veterans eligible for CRC screening. Age range: > 50 years N = 775	Veteran Affairs (VA) Medical Centre, San Diego California. (USA)	Two aims: 1) To determine whether a mailed educational reminder increases gFOBT screening rates. 2) To examine predictors of gFOBT compliance.	Control group: received usual care (N = 386). Intervention group: received a mailed educational reminder emphasising the importance of screening plus mailed gFOBT kit plus quote from CRC survivor plus 24/7 contact information (N = 389).	gFOBT at 6 months.	At 6 months 64.6% vs. 48.4% of the intervention and control group respectively, had returned the gFOBT cards (*p*<0.001) Receiving a mailed reminder significantly increased the likelihood of returning the gFOBT kit (OR 2.02, 95% CI: 1.29-2.70).
Leffler et al., 2011	Patients eligible for screening colonoscopy. Age (m): 60 years N = 830	Large gastroenterology referral centre in Boston. (USA)	To test the effectiveness of a novel follow-up management system incorporated in Electronic Health Records (EHRs) for patients due for colonoscopy surveillance examinations.	Control group: received usual care (N = 291). Intervention group: received a newly developed automated reminders system including letters sent to the patient and the physician prompting upcoming colonoscopy examinations (N = 539).	Colonoscopy at 6 months.	At 6 months 44.7% vs. 22.6% of the intervention and control group respectively had screening procedures scheduled or completed (*p*<.0001).
Levy et al., 2012	Patients due for CRC screening.	16 rural family	To test whether mailed educational	Control group: mailed written and DVD educational materials with FIT (N = 186).	FIT at 6 months.	No difference was observed for FIT return rates between

	Age range: 52-79 years N = 373	medicine/physician offices in the Iowa Research Network. (USA)	materials and FIT, with or without a scripted telephone reminder, increased FIT testing. Also to compare attitudes toward, readiness for and barriers to screening from baseline to follow up.	Intervention group: same as control group plus a telephone call designed to encourage screening and address barriers. Telephone calls were structured to assess knowledge of CRC screening, perceptions, provide basic knowledge, assess willingness to undergo screening, facilitate preferred screening test, provide supportive feedback (N= 187).		the groups: 45.2% and 48.7% for the control and intervention group respectively, *p* = .498. Comparing baseline with follow-up summary attitude scores improved (*p*<.0001), readiness scores improved (*p*<.0001) and there were fewer barriers (*p* = .034).
Levy et al., 2013	Patients due for CRC screening Age range: 52-79 years N = 743	16 rural family medicine/physician offices in the Iowa Research Network. (USA)	To test the efficacy of three physician and patient reminder systems to increase CRC screening rates in rural practices.	Control group: received usual care (N = 185). G1: Chart reminder group: physician reminders on patients' charts (N = 185). G2: Mailed education/FIT group: same package as G2 plus mailed educational materials, brochures, a DVD, a magnet and a FIT kit (N = 186). G3: Mailed education/FIT plus phone call group: same package as G3 plus a structured phone call from project staff, to provide education, assess interest in screening, explain screening tests, address barriers and encourage screening participation (N = 187).	gFOBT, FIT, colonoscopy, FS or barium enema at 15 months.	Both FIT and colonoscopy rates increased significantly in both mailed education groups (56.5% and 57.2% for G2 and G3 respectively; *p*<.05 compared to usual care) but no effect for G1 (20.5%) compared to usual care (17.8%l p>.05). For G3 the addition of a phone call did not further improve uptake.
Lewis et al., 2012	Patients overdue for CRC screening. Age range: 50-75 years N = 2,282	University of North Carolina, Internal Medicine practice. (USA)	To test the efficacy of a physician-linked invitation plus letter to increase CRC screening.	Control group: received intervention after study was complete (N = 782). Intervention group: received a mailed package with an information and instruction brochure, postcard to request a decision aid, reminders, assistance with making screening arrangements (N = 716).	Any CRC screening at 15 months.	For Wave A patients, rates significantly increased for the experimental group vs. control group (13.1% vs. 4.1%; 9% CI, 3.1%-14.9%). For Wave B residents' patients: no significant difference between experimental vs. control groups (1.3% vs. 1.9%, 95% CI, -2.2%-1%)

						Wave B attendings' patients: no significant increase observed in the intervention vs. control group (6.9% vs. 2.4%, 95% CI, -1.4% - 10.5%).
Ling et al., 2009	Patients eligible for CRC screening Age range: 50-79 years N = 599	10 primary cancer physician group practices in Pittsburgh. (USA)	To compare and assess the efficacy of 2 interventions; a physician intervention and patient management intervention on increasing endoscopic bowel screening uptake.	Control group: received usual care (N = 124). G1: intervention arm 1: Tailored letter (used personalised salutation, acknowledged personal physician and contained patient-specific information) plus non-enhanced management (N = 133). G2: Intervention arm 2: non-tailored letter plus enhanced management (helped patients with office protocols implementing screening, referrals and administrative issues) (N = 190). G3: Intervention arm 3: tailored letter plus enhanced management (N = 152).	FS, colonoscopy at 12 months.	Enhanced management increased the odds of completing a colonoscopy or FS by 1.63-fold (95% CI: 1.11-2.41; *p* = .01) The tailored letter did not significantly increase the odds of screening completion (OR: 1.08, 95% CI: 0.72-1.62; *p* = .71). Screening rates were 37.9%, 43.6%, 54.2% and 53.3% in the control group, G1, G2 and G3 respectively (absolute difference with control group: 5.7%, 16.3%, 15.4% for G1, G2 and G3 respectively).
Lo et al., 2014	Adults due for biennial gFOBT screening. Age range: 60-69 years N = 23,182	Greater London Hub area which is socioeconomically diverse and has poor overall gFOBT uptake. (UK)	Two aims: 1) To assess the efficacy of an Implementations Intentions (IIs) intervention to increase CRC screening rates. 2) To examine differential efficacy by socioeconomic deprivation.	Control group: received usual care (i.e. gFOBT plus standard instruction leaflet) (N = 12,414). Intervention group: Same package as the control group plus a modified leaflet with three pre-formulated IIs plans. (N = 10,768).	gFOBT (unclear follow-up).	There was no difference in uptake rates between the control (40.4%) and intervention group (39.7%) (OR 0.97; 95% CI: 0.91-1.04). The intervention had a small, positive effect for the most deprived quintile (OR 1.03, 95% CI: 1.01-1.21) but no effect for the middle quintile and a negative effect for the least deprived quintile.

Marcus et al., 2005	Adults 50 years or older. Age range: 50-70plus N = 4,014	Nine regional Cancer Information Service offices across the USA.	To test the efficacy of targeted and tailored print materials against untailored print materials to increase CRC screening rates.	Control group: Single Untailored (SU) group: a single untailored mail out of print material (N = 699). G1: Single Tailored (ST) group: a single tailored mail out of print material (N = 576). G2: Multiple Tailored (MT) group: 4 mail outs of print materials tailored to information provided at baseline interviews (N = 530). G3: Multiple Retailored (MRT) group: 4 mail outs of print materials retailored based on updated information obtained at 6-month follow-up interviews (N = 549).	gFOBT, FS or colonoscopy at 14 months.	A significant linear trend was found across the SU, ST, MT, MRT groups at 14 months (42%, 44%, 51% and 48% respectively, $p = 0.05$). Only for MT was there a significant difference compared with SU ($p = 0.03$). No differences were found between MT vs. MRT at 14 months.
Maxwell et al., 2010	Filipino American participants, non- adherent to CRC screening. Age range: 50-70 years N = 548	Filipino American community-based organisations and churches in Los Angeles. (USA)	To assess the efficacy of a multicomponent intervention on increasing CRC screening among an Asian American population.	Control group: patients attended a small-group session promoting physical activity (N = 163). G1: Intervention arm 1: patients attended a small-group educational session (guided by the Health Behaviour Framework) regarding CRC and screening plus take-home materials plus reminder letter to patient and physician plus free gFOBT kit (N = 202). G2: Intervention arm 2: same as G1 but without free gFOBT kit (N = 183).	Any CRC screening at 6 months.	Screening rates were 9%, 30% and 25% for the control group, G1 and G2 respectively (absolute difference with control group: 21% and 16% for G1 and G2 respectively). G1 and G2 participants were significantly more likely to report screening at follow-up than controls (G1: OR, 4.9; 95% CI, 2.4 – 9.9, $p<.001$ and G2: OR 3.7; 95% CI: 1.8-7.5, $p<.001$).
Maxwell et al., 2016	Filipino Americans previously non-adherent to CRC screening.	Filipino American community organisations that has previously	To evaluate two strategies to implement an evidence-based intervention to promote CRC	Active control: Basic Implementation Arm: involved education of Community Health Advisors (CHAs) on CRC and CRC screening, group education sessions and provided patient navigation services (i.e. assistance with referral, insurance processes, inform patient about test	Any CRC screening at 6 months.	There was not a statistically significant difference in screening uptake between the control (49%) and intervention (53%) group at 6-month follow-up.

	Age range: 50-75 years N = 673 participants, 22 community organisations	participated in promoting CRC screening. (USA)	screening in Filipino American community organisations.	results etc.) (N participants/organisations = 25/11). Intervention group: Enhanced Implementation Arm: same as active control group plus three additional components: (1) problem solving sessions related to CRC screening at three follow-up time points; (2) CHAs to attend support sessions to continue to raise awareness about CRC in the Filipino American community; (3) one leader per organisation to join an advisory board to discuss activities to increase CRC screening (N participants/organisations = 423/11).		
McGregor et al., 2016	Participants eligible for bowel cancer screening. Age range: 59-74 N = 150,417	NHS English CRC screening programme. (UK)	To test the effectiveness of adding a narrative leaflet to the current information material delivered by the NHSBCSP.	Control group: Standard invitation (SI) (N = 76,695). Intervention group: Same as G1 plus narrative leaflet (SI plus N) containing quotes and stories of the CRC screening experience from previous participants (N = 73,722).	gFOBT at 18 weeks.	Screening uptake did not differ significantly between the two groups (control: 58.5%, intervention: 56.7%, OR 0.93, CI: 0.81-1.06; p = 0.27).
Menon et al, 2011	Patients eligible for CRC screening. Age range> 50 years N = 515	Two large Mid-western medical centres and one south-eastern medical centre. (USA)	To assess the efficacy of 2 personalised telephone-based interventions: 1) tailored counseling and 2) motivational interviewing in increasing CRC screening in a predominantly black population.	Control group: received usual care (N = 169). G1: Intervention arm 1: Tailored counselling arm: Participants' beliefs, stage of readiness and demographics were documented in a computer system which then generated tailored health messages on CRC screening (N = 168). G2: Intervention arm 2: Motivational Interview arm: patients received a telephone-based motivational interview sessions to help them explore and resolve their ambivalence regarding CRC screening (N = 178).	Any CRC screening at 12 months.	CRC screening rates were: 11.8%, 23.8% and 18.5% for the control group, G1 and G2 respectively; p<.05 for G1 and G2 when compared to control. Participants in G1 were 2 times more likely to be screened (0R 2.3, 95% CI: 1.3-4.1, p<.05).

				Both interventions were guided by Health Belief Model and Transtheoretical Model of Change theoretical principles		
Miller et al., 2005	Patients eligible for CRC screening. Age range: 50-86 years N = 93	University-affiliated, community-based internal medicine outpatient practice. (USA)	To determine the effectiveness of a multimedia computer programme to effectively teach patients about gFOBT and increase screening rates.	Control group: patients received standard nurse counselling about gFOBT screening (N = 101). Intervention group: patients interacted with an educational multimedia computer program to learn about gFOBT screening (N = 93).	gFOBT at 1 month.	Completion of gFOBT kits was similar in both groups: 62% in the intervention group vs. 63% in the control group (p = .89).
Mosen et al., 2010	Patients eligible for CRC screening. Age range: 51-80 years N = 5,905	Non-profit, health maintenance organisation (HMO) in Washington and Oregon, consisting of 15 medical clinics. (USA)	To determine the effect of an automated telephone intervention on completion of gFOBT.	Control group: received usual care (N = 2,962). Intervention group: participants received three automated phone calls that provided a description and health benefits of gFOBT (N = 2,943).	gFOBT at 6 months.	At 6 months post-call, 22.5% vs. 16% in the intervention and control group respectively had completed an gFOBT (HR 1.31, 95% CI: 1.10-1.56, p<0.001). Absolute difference: 6.5%.
Myers et al., 2007	Primary practice patients. N = 1, 546	Large urban practice in Pennsylvania (USA)	To test a targeted and tailored message delivery, both by mail and via phone outreach.	Control group: received usual care (N = 387). G1: received the Standard Intervention (SI) including: mailed letter, information booklet, gFOBT kit and reminder letter (N = 387). G2: same as G1 plus received the Tailored	gFOBT, FIT, FS, colonoscopy or DCBE X-ray procedure at 1 and 2	Screening uptake was 33%, 46%, 44% and 48% for the control, G1, G2 and G3 respectively. Screening rates were significantly higher for all 3 intervention groups compared to control (SI: p

				Intervention (TI) including messages addressing barriers (N = 386). G3: same as G2 plus received the Tailored Intervention Phone call (TIP) which included a reminder phone call by an educator (N = 386).	years.	= .001); TI: *p* = .002; TIP: *p* = < .001) but did not vary significantly across intervention groups.
Neter et al., 2014	Privately insured patients, eligible for repeat gFOBT screening. Age range: 50-74 N = 29,833	Members of the Clalit Health Services. (Israel)	To test the efficacy of an implementation intentions (IIs) technique to increase repeat gFOBT adherence.	Control group: received usual care (N = 13,920). Intervention group: Implementation Intentions arm: participants received a mailed leaflet with detailed 'if-then' plans addressing frequently occurring CRC screening barriers (N = 13,713).	gFOBT at 6 months.	gFOBT adherence was 67.9% and 71.4% for the control and intervention groups respectively (chi square: 40.58, OR 1.18, 95% CI: 1.12 - 1.24; , *p* = 0.0001). This difference remained significant after controlling for age, gender, marital status and clinic SES (OR 1.17, 95% CI: 1.11, 1.23, *p*<0.0001).
O'Carroll et al., 2015	Participants eligible for bowel cancer screening. Age range: 50-74 N = 60,000	Scottish National CRC Screening programme. (UK)	To test the feasibility of an Anticipated Regret (AR) questionnaire-based manipulation to increase gFOBT uptake in Scotland across all socio-economic groups.	Control group: Standard pre-notification leaflet (N = 19,604). G1: Health Locus of Control (HLOC): Same as control plus HLOC questionnaire (N = 19,828). G2: Anticipated Regret (AR): Same as G1 plus HLOC plus AR questionnaire (N = 19,934).	gFOBT at 6 months.	No overall differences were seen between the treatment groups on gFOBT uptake (control: 57.3%, G1: 56.9%, G2: 57.4%). AR indirectly affected gFOBT uptake via intention, whilst ICK directly affected gFOBT uptake over and above intention.
Ornstein et al., 2010	Patients eligible for CRC screening. Age range: >50 years N	Family medicine practices in a research network operating across the USA.	To assess the impact of a quality improvement (QI) intervention on increasing CRC screening rates.	Control group: received usual care (N practices/patients = 16/37,258). Intervention group: practices received frequent EMR-based audit and feedback plus practice site visits for academic detailing plus 'best-practice' dissemination in annual meetings; all aimed at tracking CRC referral and screening performance	gFOBT, FS and colonoscopy at 2 years.	Screening uptake rates were significantly higher for patients in the intervention group compared to controls (71.2% and 62.8% respectively, *p*<.0001). This effect was present only for patients 50-75 years but not

	(practices/patients) = 32/68,150	(USA)		(N practices/patients = 16/30,892).		for <75 years.
Percac-Lima et al., 2009	Low-income, non-English speaking patients overdue for CRC screening. Age range = 52-79 years N = 1,223	Urban community health centre Chelsea, Massachusetts. (USA)	To evaluate the efficacy of a culturally-tailored, patient navigation intervention to increase CRC screening among a low-income, ethnically diverse population.	Control group: received usual care but received a delayed intervention upon study completion (N = 409). Intervention group: Received: (1) Introductory, educational letter in native language; (2) Phone call or in-person contact with language concordant patient navigators to address cultural barriers; (3) Help with procedure scheduling, translation and explanation of bowel preparation, help with transportation and insurance coverage (N = 814).	Colonoscopy, FS, barium enema, gFOBT at 9 months.	Intervention patients had higher CRC screening rates than controls (27% vs. 12% for any screening method, p<.001; 21% vs. 10% for colonoscopy, p<.001).
Phillips et al., 2015	Female primary care patients eligible for bowel cancer screening. Age range: 50-74 years. N = 600	A family medicine practice. (USA)	To assess the differential effects of low-cost automated telephone and mailed interventions on CRC screening rates in a primary care practice.	Control group: participants received a personalised letter with information on CRC screening and screening options (N = 198). G1: Automated call intervention: participants received automated phone calls containing messages similar to those in the letter (N = 199). G2: Both: Participants received both the letter and automated calls (N = 203).	Any CRC screening at 3 months.	Screening rates were 17%, 14% and 24% for the control group, G1 and G2 respectively. G2 had a statistically higher screening rate (p<.05) compared with either the control group or G1.
Pignone et al., 2000	Patients eligible for CRC screening. Age range: 50-75 years N = 249	3 community primary care practices (PCPs) in central North Carolina.	To test whether a decision aid consisting of an educational video, targeted brochure and chart marker can increase CRC screening rates in PCPs.	Control group: participants viewed a video about automobile safety plus generic brochure on automobile safety (N = 124). Intervention group: participants viewed an 11-minute video about CRC screening plus chose a colour-coded educational brochure based on their stage of change to indicate their degree of interest in screening plus a chart marker of the same colour was attached to their chart (N = 125).	Any CRC screening at 6 months.	Screening tests were completed by 36.8% in the intervention vs. 22.6% in control group; absolute increase: 14.2%, p<.05).

		(USA)				
Pignone et al., 2011	Patients eligible for CRC screening. Age range: 52-75 years N = 443	Large health plan from selected areas in Georgia and Florida. (USA)	To test whether an intervention combining a patient decision aid and academic detailing improves CRC screening uptake.	Control group: received usual care (N = 232). Intervention group: Patients received a decision-aid intervention, which outlined the pros and cons about screening and various screening options. Practices received academic detailing to facilitate CRC screening once patients were activated by the decision aid (N = 211).	Any CRC screening at 12 months.	39% in intervention vs 32.2% in the control group reported receiving screening (UOR 1.34, 95% CI: 0.99-2.05; *p* = .17). Absolute difference: 6.8%. After adjusting for certain variables this effect was greater (OR 1.64; 95% CI: 0.53-2.94, *p* = .03).
Potter et al., 2010	Patients eligible for CRC screening during an annual influenza vaccination (FLU) campaign. Age range: 50-80 years N = 114	Community pharmacies in the San Francisco. (USA)	To compare the effectiveness of 2 pharmacy-based interventions, taking place during the FLU campaign, to increase CRC screening rates.	Control group: On five dates patients were provided education and encourage to obtain screening from their primary care clinician (n = 28). Intervention group: On 17 dates patients were sent a FIT kit directly to their home group (N = 86).	Any CRC screening at 6 months.	59.3% in FIT arm and 14.8% in the education arm reported completion of CRC screening (*p*<.001). Absolute difference: 44.5%.
Potter et al., 2011	Patients eligible for CRC screening during an annual influenza vaccination (FLU) campaign. Age range: 50-75 years N = 1,372	Six community clinics in San Francisco serving multiethnic patients. (USA)	To evaluate the effectiveness of the FLU-gFOBT program when integrated with primary care visits to increase gFOBT screening.	Active control: FLU-only group: nurses provided gFOBT with FLU only when ordered by the primary care clinician during usual care (N = 695). Intervention: FLU-gFOBT group: nurses routinely initiated the offering of gFOBT to eligible patients who were given FLU (N = 677).	Any CRC screening at 18 months.	Screening uptake was significantly higher for the intervention (45.5%) compared to the active control group (35.6%) (*p* = .018).

Price-Haywood et al., 2014	Patients with limited health literacy (HL) overdue for CRC, breast and cervical cancer screening. Age range: men 50-75 years, women 40-75 years N physicians/patients= 18/168	Five clinics in New Orleans serving patients at risk for low HL. (USA)	To assess whether training primary care physicians (PCPs), in addition to audit feedback improves their communication behaviours and increases breast, CRC and cervical cancer screening among patients with limited HL.	Control clinics (N = 2): Audit only: Primary care physicians (PCPs) underwent chart audits of patients' screening status semiannually up to 24 months and received two annual feedback reports (N physicians/patients = 7/68). Intervention clinics (N = 3): Communication training plus audit: same as G1 plus PCPs received skills training that included standardised patient feedback on counseling behaviours (N physicians/patients = 11/93).	Any CRC screening at 2 years.	There were no between-group differences in screening rates except for mammography (OR 2.9, 95% CI: 1.3-6.4).
Raine et al., 2016	People eligible for bowel cancer screening. Age range: 60-74 years. N = 265,434 patients, 6,480 general practices	General practices in England. (UK)	To assess whether an endorsement of CRC screening by an individual's general practice reduced the socioeconomic gradient in the uptake of bowel cancer screening in England.	Control group: patients received the standard bowel cancer screening programme (BCSP) invitation (N = 134,011). Intervention group: patients received the same as the control group but the invitation also included a GP endorsement statement that appeared as a banner across the invitation letter saying 'Your GP practice supports the Bowel Cancer Screening Programme' (N = 131,423).	gFOBT at 18 weeks.	Uptake was 57.5% in the control and 58.2% in the intervention group. The difference in uptake was statistically significant (p<.001). There was no effect of the intervention on the socioeconomic gradient.
Resnicow et al., 2014	African Americans (AAs) overdue for CRC screening Age range = 50-74 years	Integrated, health care, delivery system in greater Detroit, Michigan	1) To examine the efficacy of minimally tailored vs. enhanced tailored CRC screening messages on CRC screening rates	Active control: Minimal EHR tailoring: Participants received two newsletters promoting CRC screening, addressing barriers, increasing motivation etc. These health messages were tailored using sociodemographic variables only (e.g. age, gender) (N = 439). Intervention: Enhanced tailoring: same as active	Colonoscopy, gFOBT, virtual colonoscopy, FS or barium enema at 12 months.	Screening rates between the active control group and the intervention group were not significantly different at follow-up (21% and 21.7% respectively, p< 0.05). Communication preference moderated the intervention

	N = 881	(USA)	among AAs. 2) To examine the moderating effect of communication preferences.	control group but health messages were tailored on demographic, psychosocial and personality variables and on communication preference (N = 442).		impact but only for the 'autonomous preference' group (i.e. control and intervention screening rates were 17.1% and 25.9%, p<0.05, respectively).
Ritvo et al, 2015	Primary care patients eligible for colorectal cancer screening. Ag range: 50-74 years. N = 5,240	Primary care practices affiliated with the Group Health Centre (GHC) in Ontario. (USA)	To assess whether a personal nurse patient navigation intervention can lead to an increase in bowel cancer screening rates.	Control group: received usual care (N =2,611). Intervention group: received the tailored navigation intervention. A trained nurse navigator contacted patients by telephone to discuss CRC screening and helped them identify and arrange their preferred screening test (N = 2,629).	Any CRC screening at 12 months.	CRC screening adherence was higher in the intervention group (35%) when compared to control (20%) and this difference in screening uptake was statistically significant (OR 2.11, CI: 1.87 – 2.39, p<.05).
Roetzheim et al., 2004	Patients eligible for CRC, breast and/or cervical screening. Age range: 50-75 years N (clinics/patients) = 8/1,196	8 primary care clinics in a county-funded health insurance plan in Florida. (USA)	To assess the efficacy of the Cancer Screening Office Systems (Cancer SOS) intervention designed to increase breast cancer, cervical cancer and CRC cancer screening in primary care setting serving mainly disadvantaged populations.	Control clinics (N clinics/participants = 4/600): Patients received usual care. Intervention clinics (N clinics/participants = 4/596): received a non-computerised, low-cost office system to increase screening for the 3 cancers; it consisted of a cancer screening checklist to assess screening referrals and completed screening plus unannounced audits plus feedback sessions on performance.	gFOBT, mammography, pap smear at 12 months.	At 1 year the intervention increased the odds of gFOBT screening (OR 2.5-95% CI: 1.65-4.0, p< .0001).
Ruffin et al., 2007	Patients eligible for CRC screening.	3 communities with high	To assess the efficacy of a specially designed	Control group: participants viewed a standard website with a non-interactive format (N = 87).	Any CRC screening at 6	Intervention participants were significantly more likely to get screened for CRC than

	Age range: >50 years N = 174	CRC burden and large ethnic minority population. (USA)	website to promote CRC screening (CRC Web) to a standard website on CRC screening.	Intervention group: participants viewed an interactive website aimed at helping adults establish a screening option preference (i.e. decision aid) and facilitating screening behaviour (N = 87).	months.	control participants; OR 3.23, 95% CI: 2.73-3.50, *p* = 0.035.
Salimzadeh et al., 2014	Participants eligible for CRC screening. Age range: >50 years N = 360	12 health clubs of a municipal district in Tehran. (Iran)	To assess whether a theory-based intervention guided by the preventive health model is effective in increasing CRC screening in community, lay health organisations.	Control group: received usual care (N = 180). Intervention group: participants received a preventive health model-based educational program on CRC screening plus a reminder call during which participants discussed facts about CRC, screening options and had the chance to express concerns relating common screening barriers (N = 180).	Any CRC screening at 4 months.	The screening rate for CRC was significantly higher in the intervention (31%) vs. the control group (2.8) (OR 15.93, 95% CI: 5.57, 45.53, *p*<.05).
Schroy et al., 2012	Patients eligible for CRC screening. Age range: 50-75 years N = 825	An urban, academic safety-net hospital and community health centre.	To assess the impact of a decision aid-assisted shared decision making (SDM) intervention on CRC screening uptake.	Control group: received usual care plus a modified online version of a leaflet discussing generic lifestyle changes (other than screening) for minimising risk for preventable diseases (N = 276). G1: Intervention arm 1: decision aid plus personalised risk assessment (N = 280). G2: Intervention arm 2: decision aid only (N = 269).	Any CRC screening at 12 months.	Patients in G2 were significantly more likely to complete a screening test than controls (43.1% vs. 34.8%, absolute difference: 8.3%, *p* = 0.046) within 12 months. The screening rates between the 2 intervention arms were similar (43.1% vs. 37.1%, *p* = 0.15).
Sequist et al., 2009	Patients overdue for CRC screening. Age range: 50-80 years	11 ambulatory health care centres in Massachusetts.	To compare the individual and joint impact of personalised mailings to patients and electronic	Patient intervention: 2 groups: Control group: received usual care (N = 10,930). Intervention group: received cover letter indicating overdue screening status plus educational pamphlet plus gFOBT kit plus phone number to	Any CRC screening at 15 months.	Screening rates were significantly higher among patients who received mailings (i.e. intervention) vs. those who didn't (i.e. control) (44% vs. 38.1%, *p*<.001).

	N (patients/physicians)= 21,860/110	(USA)	reminders to primary care physicians (PCPs) to increase CRC screening rates.	schedule endoscopic procedures (N = 10,930). Physician intervention (not included in meta-analysis as not clear whether the participant sample was different from the sample in the patient intervention): 2 groups: G1: Control group: received usual care (N physicians/patients = 55/10,912). G2: Intervention group: physicians received electronic reminders during office visits with their patients overdue for CRC screening. Alerts were presented in both active and passive form within each patient's EHR. The active alert required acknowledgement from physicians (N physicians/patients = 55/10,948).		Screening rates were similar among patients of physicians receiving electronic reminders and the control group (41.9% vs. 40.2%, *p* = .47).
Sequist et al., 2011	Patients overdue for CRC screening. Age range: 50-75 years N = 1,103	A multispecialty group practice comprising 14 ambulatory health centres in Massachusetts. (USA)	To assess whether electronic patient messages and personalised risk assessments delivered via an electronic personal health record could increase screening rates.	Control group: received usual care (N = 551). Intervention group: received a single electronic message highlighting overdue screening status with a link to a Web-based tool to assess their personal risk for CRC (N = 552).	FS, gFOBT and colonoscopy at 4 months.	Screening rates were higher at 1 month for the intervention group compared to the control group (8.3% vs 0.2%, absolute difference 8.1% *p*<.001) but this difference was no longer significant at 4 months (15.8% vs 13.1%, absolute difference 2.7%, *p* = .18).
Shankleman et al., 2014	Patients eligible for gFOBT screening Age range: 59-70 years N = 9,113	18 intervention general practices and 24 control practices in East	To assess the effectiveness of 2 interventions; (1) face-to-face health promotion at general practice (2) health promotion delivered by phone	Control GP practices: received usual care (i.e. NHS BCSP invitation) (N practices/patients: 24/5,227). G1: Intervention arm 1: Health Promotion (HP) over the telephone: received standard invitation plus bilingual advocates phoned subjects a week after sending letters (3 attempts in total) plus	gFOBT at 8 months.	Median gFOBT uptake was 46.7% in the telephone intervention, 43.8% in the face-to-face intervention and 39.1% in comparison practices (absolute difference: 7.6% and 4.7% for G1 and G2 respectively, *p*

		London.	among low SES and ethnic diversity populations	callers offered CRC information and answered participants' questions (N practices/patients: 9/2,034). G2: intervention arm 2: face-to-face HP: received standard invitation letter plus an invitation to attend a group health information session at the GP practice, which were held monthly and attendees were offered additional pictorial and multi-lingual guides to the test procedure (N practices/patients: 9/1,852).		= .001 when comparing either G1 or G2 to control).
Shaw et al., 2013	Patients eligible for CRC screening. Age range: 50-70 years N practices/patients = /23673	23 primary care practices in New Jersey. (USA)	To evaluate a primary care practice-based quality improvement intervention (QI) aimed at improving CRC screening rates.	Control practices: received usual care (N practices/patients: 11/320). Intervention practices: practices received a quality improvement (QI) intervention with three components: a multimethod assessment process plus a reflective adaptive process plus learning collaborative process (N practices/patients: 12/353).	Any CRC screening at 12 months.	There were no observed differences in CRC screening rates between control and intervention practices (38% and 53% respectively; *p*>.05).
Simon et al., 2010	Participants eligible for first-time CRC screening. Age range: 50-64 years N = 20,938	Health care network in Massachusetts. (USA)	To assess whether an automated telephone outreach with speech recognition (ATO-SR) can increase CRC screening rates.	Control group: received usual care (N = 10,432). Intervention group: patients received the ATO-SR; a single interactive outreach call using speech recognition to engage participants in conversation about the importance of CRC screening and options for and barriers to screening (N = 10,506). The ATO-SR was designed to reflect the insights of the General Model of Determinants of Behaviour Change.	Any CRC screening at 12 months.	The incidence of any CRC screening was 30.6% in the intervention group and 30.4% in the usual care group (*p* = .76). The intervention effect remained insignificant after adjusting for covariates (AOR 1.01; 95% CI: 0.94-1.07).
Stokamer et al., 2005	Participants referred for gFOBT.	Department of Veteran Affairs primary	To determine whether intensive patient education increases gFOBT	Control group: received standard patient education: only received the gFOBT cards and written instructions on how to properly collect stool specimens for gFOBT (N = 392).	gFOBT at 6 months.	Patients in the intervention group were more likely than controls to return gFOBT cards (65.9% vs. 51.3%;

	Age range: >50 years N = 788	care clinic in NYC. (USA)	uptake.	Intervention group: received intensive patient education plus a one-on-one education session by a primary care nurse on the importance of CRC screening plus received advice on how to properly collect stool samples for gFOBT plus received a 2-page handout on CRC screening (N = 396).		absolute difference: 14.6%, *p* <.001).
Tu et al., 2006	Chinese-Americans eligible for gFOBT screening. Age range: 50-78 years N = 210	A community clinic serving predominantly Asians in Seattle, Washington. (USA)	To evaluate a clinic-based, culturally and linguistically appropriate intervention to increase gFOBT screening rates among Chinese Americans.	Control group: received usual care (N = 105). Intervention group: trilingual and bicultural health educators delivered bilingual materials (video, pamphlet plus gFOBT instructions) and a gFOBT kit (N = 105).	gFOBT at 6 months.	69.5% of the intervention patients received gFOBT screening vs. 27.6% of the control patients (OR 5.98; 95% CI: 3.29, 10.85, absolute difference: 41.9%, *p*<.05).
Tinmouth et al., 2014	People previously non-adherent with CRC screening. Age range: 50-74 years. N = 3,594	Primary care cancer screening programme in Ontario. (Canada)	To assess whether adding an gFOBT kit to a mailed invitation increases CRC screening among non-responders.	Control group: received usual care (N = 1,586). Intervention group: patients received a gFOBT kit alongside the standard screening invitation (N = 2,008).	Any CRC screening at 6 months.	Uptake was 11.5% and 21.6% for the control and intervention group respectively (*p*<.001).
van Roon et al., 2011	Adults eligible for CRC screening. Age range: 50-74 years N = 5,000	Amsterdam, Netherlands	To test whether an advance notification letter increases CRC-screening adherence.	Control group: received usual care (N = 2,493). Intervention group: usual care plus advance notification letter (2 weeks in advance of invitation) containing information about CRC screening (N = 2,507).	FIT at 8 months.	Sending an advance notification letter and invitation was associated with significantly higher adherence compared to sending an invitation letter alone (57.8% vs. 51.5% respectively, *p* = <.001).

Van Roosbroeck and van Hal., 2012	Patients eligible for CRC screening. Age range: 50-74 years N = 19,542	Three selected areas (1 urban, 1 residential and 1 rural) in Flanders. (Belgium)	To compare the effects of 2 invitation strategies on CRC screening uptake rates.	Control group: GP group: an invitation letter without a FIT kit was sent by mail, with instructions to visit the GP for further information on screening and the FIT kit was provided by the GP (N = 8,052). Intervention group: Mail group: patients received a direct invitation letter with a FIT kit sent by mail (N = 11,490).	FIT (follow-up unclear)	Screening uptake was significantly higher for the intervention compared to the control group 52.3% vs. 27.7% respectively, *p*<.0001). After controlling for age gender and area, screening rates were 3 times higher in the intervention group vs. the control group (OR 2.96, 95% CI: 2.78-3.14, *p*<.001).
Vernon et al., 2011	Patients overdue for CRC screening. Age range: 50-70 years N = 1,224	A large medical group practice in the greater Houston, Texas, area. (USA)	To test the effectiveness of a tailored, interactive intervention to increase CRC screening.	All patients had received general check-ups in the last 12 months. Control group: Survey-only group: baseline survey (questions about their check-up) and a 6-month survey (questions about screening decision) (n = 413). G1: Generic web-site group: Same as the control group plus viewed information about CRC screening on a publicly available website. (N = 398). G2: Tailored group: received interactive, computer-delivered intervention about CRC screening. The trans-theoretical model of change was the primary theoretical framework (N = 413).	Colonoscopy, FS, barium enema, gFOBT At 6 and 12 months.	No significant differences were found in screening rates by 12 months (34.1%, 35.7% and 32.9% for the control, G1 and G2 respectively; *p*>0.05). 23 participants showed increased knowledge at 2 weeks: (*p*<.004) and 6 months (*p*<.004) compared to the control group and G1 - and CRC screening efficacy at 2 weeks (*p*<.001) and 6 months (*p*=.009).
Vinker et al., 2002	Adults eligible for CRC screening. Age range: 50-75 years	Two primary care clinics. (Israel)	To test the effectiveness of physician and patient reminders to increase gFOBT screening rates.	Control group: received usual care (N = 913). G1: Physician reminder group (N = 753). G2: Patient reminder: Phone call reminder (N = 312).	gFOBT at 12 months.	Screening uptake was significantly higher in G1, G2, G3 compared to the control group (16.5%, 14.7%, 9.2% vs 1.3% respectively, *p*<.001).

	N = 2,315			G3: Patient reminder: Letter reminder (N = 329).		
Walsh et al., 2005	Patients non-adherent to CRC screening. Age range: 50-79 years N physicians/patients = 94/7,933	Primary care physicians (PCPs) recruited from a large individual practitioner association providing managed care in San Francisco. (USA)	To assess whether a physician and patient directed intervention involving academic detailing and direct mailings, increases the rate of CRC screening.	Control group: received usual care (N physicians/patients: 44/3,717). Intervention group: Physicians underwent academic detailing through participating in educational seminars plus identified potential CRC screening issues for discussion plus the importance of recommendation was emphasised. Patients received a personalised letter plus educational brochure plus gFOBT kit (N physicians/patients: 50/4,276).	Any CRC screening at 12 months.	No significant increase was observed in any CRC screening that occurred in the intervention group versus the control group: (12.7% vs 12.5%, absolute difference: 0.2%, p = .51).
Walsh et al., 2010	Latino and Vietnamese primary care patients. Age range: 50-79 years N = 1,789	Large public hospital in Santa Clara. (USA)	To assess whether culturally tailored brochures with or without telephone counselling can increase CRC screening among Latinos and Vietnamese.	Control group: received usual care (N = 256). G1: Basic intervention group: patients received a culturally tailored brochure plus gFOBT kit (N = 765). G2: Enhanced intervention group: brochure as in G1 plus gFOBT kit plus telephone counselling (N = 768).	Any CRC screening at 12 months.	Screening rates increased by 7.8%, 15.1% and 25.1% in the control group, G1 and G2 respectively (p<0.01 between each intervention and the control and between G1 and G2).
Wardle et al., 2003	A “harder-to-reach” population eligible for CRC screening. Age range: 55-64 years N = 2,966	14 trial centres to recruit patients registered with GPs in London. (UK)	To assess whether a mailed intervention designed to address CRC screening barriers and modify negative attitudes towards FS would increase screening attendance.	G1: Control group: received usual care (n = 1,513). G2: Intervention group: received a mailed psychoeducational intervention (booklet) three weeks before receiving the usual screening invitation. Booklet educational materials drew on various frameworks; health belief model (HBM), Theory of Planned Behaviour and regret theories to address screening barriers and increase positive expectations (N = 1,453).	FS at 3 months.	FS screening rates were significantly higher in G2 vs. G1 (53.2% vs. 49.9%). Absolute difference: 3.6%, p< .05.
Wardle et al., 2016	People eligible for bowel cancer screening.	The English NHS Bowel Cancer	To assess 4 interventions aimed at reducing the	4 trials: Trial 1: Gist leaflet	gFOBT at 18 weeks.	Trials 1 and 2 showed no effects on the SE gradient of uptake or overall uptake.

	Age range: 50-74 years N = 745,011	Screening Programme. (UK)	socioeconomic (SE) gradient in bowel cancer screening uptake.	G1: Control: patients received standard information (N = 78,971) G2: Intervention: patients received standard information with added gist leaflet (N = 84,283). <u>Trial 2: Narrative leaflet</u> G1: Control: patients received standard information (N = 76,421) G2: Intervention: patients received standard information with added narrative leaflet (N = 73,450). <u>Trial 3: General practice endorsement</u> G1: Control: patients received standard information (N = 133,449) G2: Intervention: patients received standard information with added GP endorsement banner in letter (N = 130,876). <u>Trial 4: Enhanced reminder letter</u> (only targeted individuals who had not responded within 4 weeks of invitation letter). G1: Control: patients received standard information (N = 90,002) G2: Intervention: patients received standard reminder letter with added banner and text (N = 77,739).		Trial 3 showed no effect on SE gradient but was associated with increased overall uptake (AOR 1.07, 95% CI: 1.04-1.10, p<.0001). In Trial 4 a significant interaction was seen with SE gradient (p=.005) with a stronger effect in the most deprived quintile (p = .003) than in the least deprived (p = 0.98). For trials 1-4 overall uptake per trial was 57.7%, 56.9%, 58.4% and 25.9% for the intervention group vs. 57.4%, 58.7%, 57.7% and 25.2% in the control groups, for each trial respectively.
Weinberg et al., 2013	Unscreened women. Age range: > 50 years N = 865	Obstetrics and gynaecology practices in Pennsylvania and Georgia.	To assess the efficacy of two types of tailored, educational interventions (web- and print-based) on improving adherence to CRC screening.	Control group: usual care (N = 171). G1: Intervention arm 1: Web education tailored for high monitoring attentional style women (N = 171). G2: Intervention arm 2: Web education tailored for low monitoring attentional style women (N = 174). G3: Intervention arm 3: Print education tailored for high monitoring attentional style women (N =	Any CRC screening at 4 months.	CRC screening rates were not significantly different in the web (i.e. G1 and G2; 12.2% and 12% respectively), print (G3 and G4; 11.3% and 12.7% respectively) or control group (13.9%). Risk messages tailored to attentional style

		(USA)		176). G4: Intervention arm 4: Print education tailored for low monitoring attentional style women (N = 173). CRC screening educational content was identical for both interventions. The Cognitive Social Information Processing model was used to tailor health messages to attentional style.		had no effect on screening uptake for any group.
White et al., 2015	People eligible for bowel cancer screening in London. Age range: 60-74. N = 205,541	The English NHS Bowel Cancer Screening Programme. (UK)	To trial different combinations of three interventions aimed at increasing CRC screening uptake.	Control Group: received usual care (N = 177, 386). G1: received CRUK endorsement flyer only (N = 9,702). G2: Same as G1 plus kit enhancement pack: included plastic gloves and 'poo catchers' to make sample collection easier (N = 8,623). G3: Same as G1 plus advertising campaign: flyer plus media campaign e.g.. banners highlighting ease of use 'it's easier than you think' (N = 4,798). G4: Same as G2 plus advertising campaign: flyer plus enhancement pack plus media campaign (N = 5,032).	gFOBT at 3 months.	Screening uptake rates were 43.4%, 43%, 45.1%, 45.6% and 49.5% in the control group, G1, G2, G3 and G4 respectively. The flyer alone (G1) had no impact on screening uptake compared to control. G2 resulted in a significant increase in uptake compared to control (45.1% vs 43.4%, OR: 1.07, *p* = .047). G3 resulted in a significant increase in uptake compared to control (45.6% vs 43.4%, OR = 1.09, *p* = .027). The largest increase in uptake was observed in G4 compared to control (49.5% vs 43.4%, OR 1.28, *p*<.001).
Wilson et al., 2015	People eligible for bowel cancer screening. Age range: 50-74 years. N = 3,408	National screening programme in Australia. (Australia)	To compare the effects of a tailored computerised decision support tool vs a non-tailored computerised booklet vs paper information on	Control group: received usual care (N = 1,036). G1: Tailored Personalised Decision Support (TPDS) group: received health information tailored to their stage of readiness to screen (N = 1,137). G2: Non-Tailored Personalised Decision Support (NTPDS) group: received an online booklet with information about CRC screening (N = 1,136).	gFOBT at 3 months.	There was no significant difference in uptake between groups; screening rates were 34.5%, 32.5% and 33% for the control group, G1 and G2 respectively.

			gFOBT uptake.			
Zapka et al., 2004	Patients eligible for CRC screening. Age range: 50-75 years N = 938	5 primary care practices in central Massachusetts. (USA)	To assess the efficacy of a mailed educational video before a physical examination, on CRC screening rates especially sigmoidoscopy.	Control group: received usual care (N = 488). Intervention group: video about CRC: aimed at encouraging patients to discuss CRC screening with their physician at their upcoming periodical appointment. The videos aimed at increasing patient knowledge, reducing anxiety, and provide role modelling (based on the Precede/Proceed and Behavioural Model of Utilisation models) (N = 450).	Any but mainly FS at 6 months.	Screening rates were the same in the intervention and control groups (54.8% vs 54.9% respectively; *p*>.05).

Appendix 2.8. Risk of bias assessment of all included studies.

Study	No of participants randomised		Age range (years)	Screening test	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants & personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	ITT analysis	Overall risk of bias
	Intervention	Control										
1. Aragones et al (2010)	31	34	50-74	Any	Adequate	Unclear*	Unclear	Adequate	Adequate	Adequate	Yes	Unclear
2. Atlas et al (2013)	51,071	52,799	50-74	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Unclear	Unclear
3. Baker et al, (2014)	225	225	51-75	gFOBT	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	No	Unclear
4. Barthe et al 2015	1,895	1,527	55-70	gFOBT	Unclear	Adequate	Unclear	Unclear	Adequate	Adequate	Yes	Unclear
5. Basch et al, (2006)	226	230	52-79	Any test	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
6. Blumenthal et al (2010)	G1: 84 G2: 98 G3: 99	88	>50	Any	Inadequate**	Unclear	Unclear	Inadequate	Adequate	Adequate	Yes	High
7. Boguradzka et al (2014)	300	300	50-65	Colonoscopy	Adequate	Adequate	Adequate	Inadequate	Adequate	Adequate	No	High

8. Braun et al (2005)	69	52	>50	gFOBT	Adequate	Unclear	Unclear	Unclear	Adequate	Adequate	Unclear	Unclear
9. Braun et al (2015)	242	246	60-75	Any	Adequate	Adequate	Adequate	Inadequate	Inadequate	Adequate	Unclear	High
10. Cameron et al (2011)	314	314	50-79	Any	Adequate	Adequate	Unclear	Adequate	Adequate	Adequate	Yes	Unclear
11. Christie et al (2008)	13	8	>50	colonoscopy	Adequate	Unclear	Unclear	Unclear	Inadequate	Adequate	Unclear	High
12. Church et al (2004)	G1: 434 G2: 404	417	>50	gFOBT	Adequate	Adequate	Unclear	Inadequate	Inadequate	Adequate	Unclear	High
13. Clouston et al (2014)	1,221	1,174	50-70	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
14. Cohen-Cline et al (2014)	8,005	3,005	50-81	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Unclear	Unclear
15. Cole et al (2002)	G1: 600 G2: 600 G3: 600	600	>50	gFOBT	Adequate	Adequate	Adequate	Unclear	Adequate	Adequate	Yes	Unclear
16. Cole et al (2007)	G1: 600 G2: 600 G3: 600	600	50-74	gFOBT	Unclear	Adequate	Adequate	Unclear	Inadequate	Adequate	No	High
17. Coronado et al (2010)	G1: 168 G2: 168	165	50-79	gFOBT	Adequate	Unclear	Unclear	Inadequate	Adequate	Adequate	No	High

18. Costanza et al (2007)	1,187	1,261	50-75	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Yes	Unclear
19. Denberg et al, (2006)	386	395	>50	Colonoscopy	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
20. Dietrich et al (2006)	696	694	50-69	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
21. Dietrich et al (2007)	663	653	50-69	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Yes	Unclear
22. Dietrich et al (2013)	562	1,678	50-63	Any test	Adequate	Adequate	Adequate	Unclear	Adequate	Adequate	Yes	Unclear
23. Dignan et al (2014)	1,842	1,909	50-75	Any	Unclear	Unclear	Unclear	Inadequate	Inadequate	Adequate	No	High
24. Ferreira et al (2005)	1,015	963	>50	Any	Unclear	Unclear	Unclear	Inadequate	Adequate	Adequate	Unclear	High
25. Fiscella et al, (2011)	163	163	50-74	Any test	Inadequate	Inadequate	Unclear	Adequate	Adequate	Adequate	Yes	High
26. Fitzgibbon et al (2007)	258	728	>50	Any	Inadequate	Unclear	Unclear	Unclear	Inadequate	Adequate	Unclear	High
27. Ford et al (2006)	352	351	>55	FS	Inadequate	Unclear	Unclear	Inadequate	Inadequate	Adequate	No	High
28. Fortuna et al (2014)	G1: 157 G2: 158	156	50-74	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low

	G3: 158											
29. Ganz et al (2005)	920	930	>52	Any	Inadequate	Unclear	Unclear	Unclear	Adequate	Adequate	No	High
30. Gimeno-Garcia et al (2009)	79	79	50-79	gFOBT	Adequate	Unclear	Adequate	Adequate	Adequate	Inadequate	Unclear	High
31. Giorgi-Rossi et al (2011)	2,107	2,112	50-70	gFOBT	Adequate	Unclear	Adequate	Unclear	Adequate	Unclear	Yes	Unclear
32. Goldberg et al (2004)	59	60	50-80	gFOBT	Inadequate	Unclear	Unclear	Inadequate	Adequate	Adequate	Yes	High
33. Goldman et al (2015)	210	210	50-74	gFOBT	Unclear	Unclear	Unclear	Adequate	Adequate	Adequate	Unclear	Unclear
34. Green et al (2013)	G1: 1,169 G2:1.159 G3:1,170	1,166	50-73	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
35. Green et al (2015)	1,106	1,102	50-75	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
36. Guiriguet et al (2016)	21,619	8,196	50-69	FIT	Unclear	Unclear	Adequate	Unclear	Adequate	Adequate	Yes	Unclear
37. Gupta et al (2013)	G1: 1,593 G2: 479	3,898	54-64	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
38. Hagoel et al (2016)	G1: 9,596 G2:9,631 G3:	9,602	50-74	gFOBT	Unclear	Unclear	Unclear	Adequate	Adequate	Adequate	Unclear	Unclear

	9,632 G4:9,630											
39. Hendren et al (2013)	185	181	40-74	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Unclear	Low
40. Hewitson et al (2011)	G1: 322 G2:322 G3: 322	322	60-75	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
41. Holt et al (2012)	152	133	50-74	Any	Adequate	Unclear	Unclear	Unclear	Adequate	Adequate	Unclear	Unclear
42. Horne et al (2015)	578	642	65-75	Any	Unclear	Unclear	Adequate	Inadequate	Inadequate	Adequate	Unclear	High
43. Hwang et al (2013)	153	153	>50	Any	Adequate	Adequate	Unclear	Inadequate	Adequate	Adequate	Yes	High
44. Inadomi et al (2012)	G1: 321 G2:332 G3: 321	No control group	50-79	gFOBT/ colonos copy	Adequate	Adequate	Unclear	Unclear	Adequate	Adequate	Unclear	Unclear
45. Jandorf et al (2013)	G1: 181 G2: 123	46	>50	Colonos copy	Adequate	Unclear	Unclear	Unclear	Inadequate	Adequate	Unclear	High
46. Jean-Jacques et al, (2012)	104	98	50-80	gFOBT, FS, colono-scopy	Adequate	Unclear	Unclear	Adequate	Inadequate	Adequate	No	High
47. Jensen et al (2014)	G1: 72 G2: 72 G3: 72 G4: 72	72	50-75	Any	Unclear	Unclear	Unclear	Adequate	Adequate	Adequate	No	Unclear
48. Katz et al (2012)	138	132	>50	Any	Adequate	Unclear	Adequate	Unclear	Adequate	Adequate	Yes	Unclear

49. Krok-Schoen et al (2015)	566	525	51-75	Any	Unclear	Unclear	Inadequate	Adequate	Inadequate	Adequate	Unclear	High
50. Lasser et al, (2011)	235	230	52-74	Any test	Adequate	Adequate	Unclear	Adequate	Adequate	Adequate	Yes	Unclear
51. Lee et al (2009)	389	386	>50	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
52. Leffler et al (2011)	539	291	>50	gFOBT	Adequate	Adequate	Unclear	Unclear	Adequate	Adequate	Yes	Unclear
53. Levy et al (2012)	187	186	52-79	FIT	Unclear	Unclear	Unclear	Unclear	Inadequate	Adequate	Unclear	High
54. Levy et al, (2013)	G1: 185 G2: 186 G3: 187	185	52-79	Any test	Adequate	Unclear	Unclear	Adequate	Adequate	Adequate	Yes	Unclear
55. Lewis et al, (2012)	716	782	50-75	Any test	Inadequate	Inadequate	Inadequate	Unclear	Inadequate	Adequate	No	High
56. Ling et al (2009)	G1: 133 G2: 190 G3: 152	124	50-79	FS, colonoscopy	Adequate	Adequate	Adequate	Unclear	Inadequate	Adequate	Unclear	High
57. Lo et al, (2013)	12,414	10,768	50-74	gFOBT	Adequate	Unclear	Unclear	Unclear	Unclear	Inadequate	No	High
58. Marcus et al, (2005)	G1: 576 G2: 530 G3: 549	698	50+	gFOBT, FS, colonoscopy	Unclear	Unclear	Unclear	Inadequate	Adequate	Adequate	Yes	High
59. Maxwell												

et al (2010)	G1: 202 G2: 183	163	50-70	Any	Adequate	Unclear	Unclear	Inadequate	Adequate	Adequate	Yes	High
60. Maxwell et al (2015)	423	250	50-75	Any	Adequate	Adequate	Unclear	Inadequate	Adequate	Adequate	No	High
61. McGregor et al (2015)	73,722	76,695	60-74	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	No	Low
62. Menon et al (2011)	G1: 168 G2: 178	169	>59	Any	Inadequate	Inadequate	Inadequate	Unclear	Adequate	Adequate	No	High
63. Miller et al (2005)	93	101	50-86	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Unclear	Low
64. Mosen et al (2010)	2,943	2,962	51-80	gFOBT	Adequate	Unclear	Unclear	Unclear	Adequate	Adequate	No	Unclear
65. Myers et al, (2007)	G1: 387 G2: 386 G3: 386	387	50-74	Any test	Unclear	Unclear	Unclear	Adequate	Adequate	Adequate	Yes	Unclear
66. Neter et al (2014)	13,677	13,878	50-74	gFOBT	Unclear	Unclear	Adequate	Unclear	Adequate	Adequate	Unclear	Unclear
67. O'Carroll et al (2015)	G1: 19,828 G2:19,934	19,604	60-74	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
68. Ornstein et al (2010)	30,892	37,258	>50	Any	Adequate	Unclear	Adequate	Inadequate	Adequate	Adequate	Unclear	High
69. Percac-Lima et al, (2008)	409	814	52-79	Any	Unclear	Inadequate	Adequate	Unclear	Adequate	Adequate	Yes	High
70. Phillips et al (2015)	G1: 198 G2: 199 G3: 203	No control group	50-74	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Unclear	Low

71. Pignone et al (2000)	125	124	50-75	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
72. Pignone et al (2011)	211	232	52-75	Any	Inadequate	Unclear	Unclear	Inadequate	Adequate	Adequate	Unclear	High
73. Potter et al (2010)	86	28	50-75	Any	Inadequate	Unclear	Adequate	Inadequate	Inadequate	Adequate	Unclear	High
74. Potter et al (2011)	695	677	50-75	Any	Inadequate	Inadequate	Inadequate	Unclear	Adequate	Adequate	Unclear	High
75. Price-Haywood et al (2014)	91	67	50-75	Any	Adequate	Unclear	Inadequate	Inadequate	Adequate	Adequate	No	High
76. Raine et al (2015)	131,423	134,011	50-74	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
77. Resnicow et al, (2014)	439	442	50-74	Any	Unclear	Unclear	Unclear	Unclear	Inadequate	Adequate	No	High
78. Ritvo et al (2015)	2,629	2,611	50-74	Any	Adequate	Adequate	Unclear	Adequate	Adequate	Adequate	Unclear	Unclear
79. Roetzheim et al (2004)	596	600	50-75	gFOBT	Adequate	Adequate	Adequate	Unclear	Adequate	Adequate	Unclear	Unclear
80. Ruffin et al (2007)	87	87	>50	Any	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
81. Salimzadeh et al (2014)	170	143	>50	Any	Adequate	Inadequate	Inadequate	Inadequate	Adequate	Adequate	No	High
82. Schroy et al (2012)	G1: 280	276	50-80	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Yes	Unclear

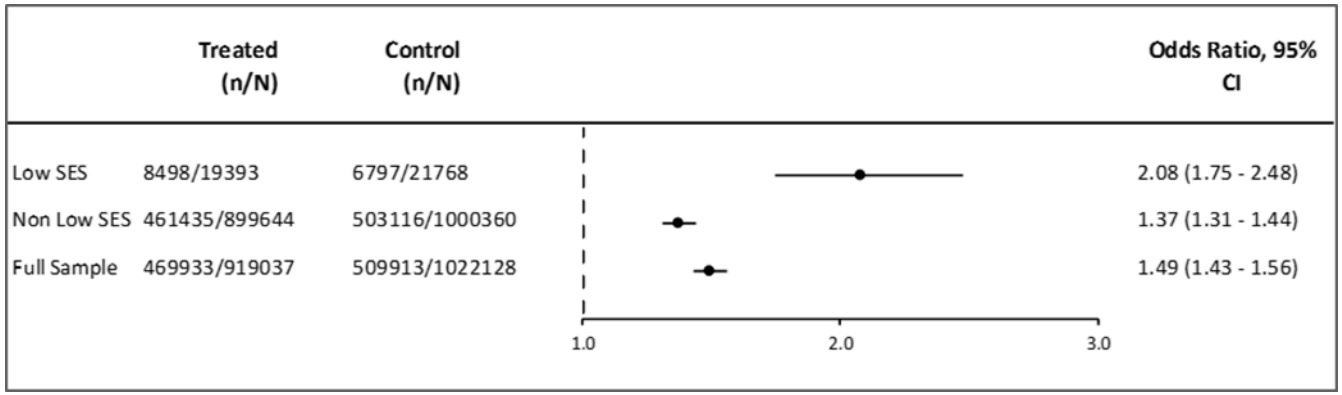
	G2: 269											
83. Sequist et al (2009)	10,930	10,930	50-80	Any	Unclear	Unclear	Unclear	Unclear	Inadequate	Adequate	Yes	High
84. Sequist et al (2011)	552	551	50-75	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Unclear	Unclear
85. Shankleman et al (2014)	G1: 2,034 G2: 1,852	5,227	59-70	gFOBT	Unclear	Unclear	Unclear	Unclear	Inadequate	Adequate	Yes	High
86. Shaw et al (2013)	353	320	50-70	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Yes	High
87. Simon et al (2010)	10,506	10,432	50-64	Any	Adequate	Unclear	Inadequate	Inadequate	Adequate	Adequate	Yes	High
88. Stokamer et al (2004)	396	392	>50	gFOBT	Adequate	Adequate	Adequate	Unclear	Adequate	Adequate`	Yes	Unclear
89. Tu et al (2006)	105	105	50-78	gFOBT	Adequate	Unclear	Unclear	Adequate	Adequate	Adequate	Unclear	Unclear
90. Tinmouth et al (2014)	2,008	1,586	50-74	Any	Unclear	Unclear	Unclear	Adequate	Unclear	Adequate	Unclear	Unclear
91. van Roon et al, (2011)	2,507	2,493	50-74	FIT	Adequate	Adequate	Adequate	Unclear	Adequate	Adequate	No	Unclear
92. Van Roosbroeck et al (2012)	8,502	11,498	50-74	FIT	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Yes	Unclear
93. Vernon et al, (2011)	G1: 398 G2: 413	413	50-70	Any test	Adequate	Inadequate	Inadequate	Adequate	Unclear	Adequate	Yes	High

94. Vinker et al, (2002)	G1: 753 G2: 312 G3: 337	913	50-75	gFOBT	Unclear	Unclear	Unclear	Unclear	Inadequate	Inadequate	Yes	High
95. Walsh et al (2005)	4,276	3,717	50-79	Any	Adequate	Unclear	Unclear	Unclear	Inadequate	Adequate	Unclear	High
96. Walsh et al (2010)	G1: 765 G2: 768	256	50-79	Any	Adequate	Unclear	Unclear	Inadequate	Adequate	Adequate	Unclear	High
97. Wardle et al (2003)	1,453	1,513	55-64	FlexiSig	Unclear	Unclear	Unclear	Unclear	Unclear	Adequate	Yes	Unclear
98. Wardle et al (2016)	G1: 84,283 G2: 73,450 G3: 130,876 G4: 77,739	C1: 78,791 G2: 76,421 G3: 133,449 G4: 90,002	60-74	gFOBT	Adequate	Adequate	Adequate	Adequate	Adequate	Adequate	Yes	Low
99. Weinberg et al (2013)	G1: 171 G2: 174 G3: 176 G4: 173	171	>50	Any	Unclear	Unclear	Unclear	Unclear	Adequate	Adequate	Yes	Unclear
100. White et al (2015)	G1: 9,702 G2: 8,623 G3: 4,798 G4: 5,032	177,386	60-74	gFOBT	Unclear	Inadequate	Adequate	Adequate	Inadequate	Inadequate	No	High
101. Wilson et al (2015)	G1: 1,137 G2: 1,136	1,135	50-74	gFOBT	Adequate	Inadequate	Inadequate	Adequate	Adequate	Adequate	Yes	High

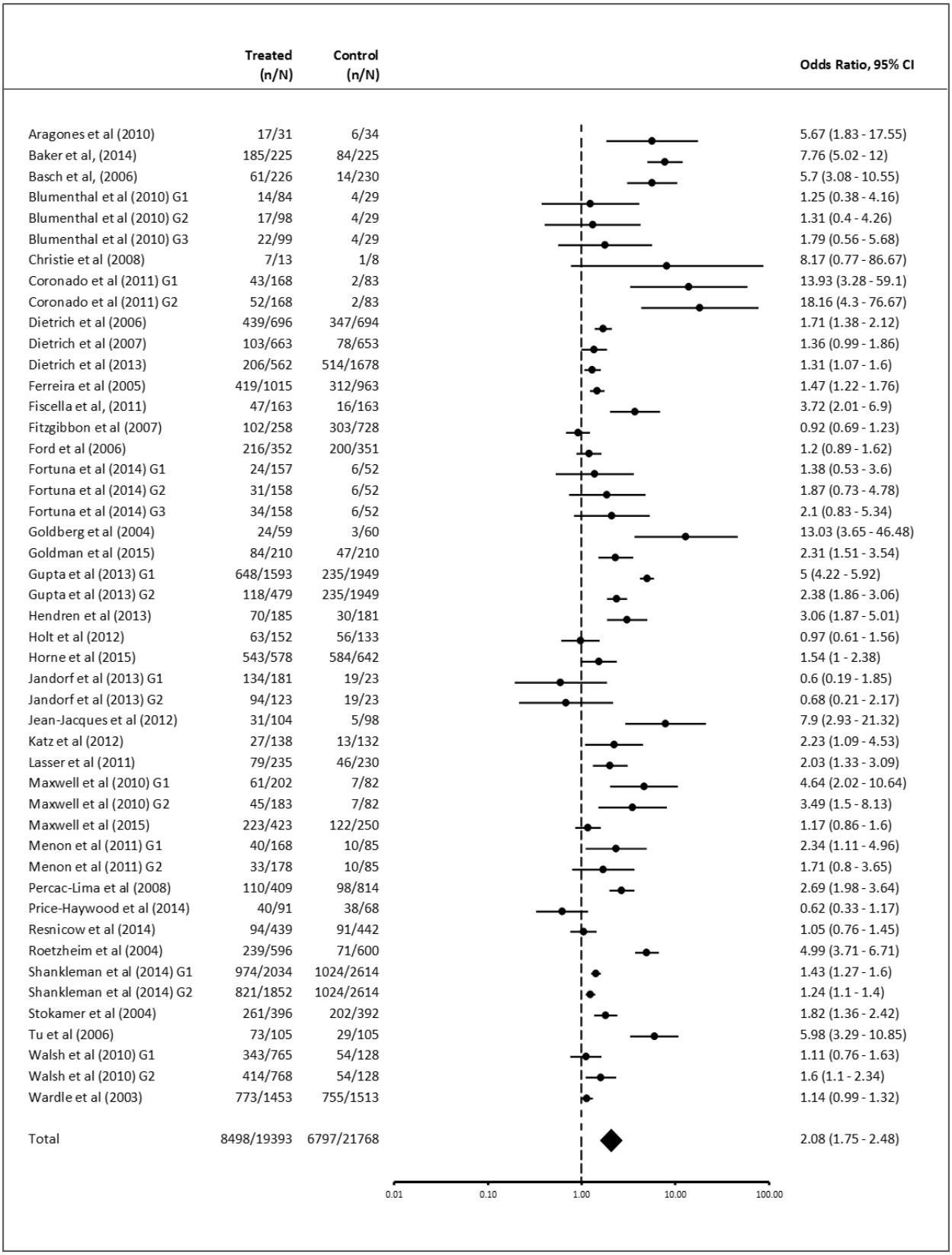
102. Zapka et al (2004)	450	488	50-75	Any	Adequate	Inadequate	Unclear	Inadequate	Adequate	Adequate	Yes	High

Notes. ITT = Intention to Treat, gFOBt = guaiac Faecal Occult Blood test, FIT = Faecal Immunochemical Test, Gs = groups: in the event of a randomised comparative effectiveness trial or clinical trial design more than one groups were compared. * Could not be assessed or not reported. ** Process of allocation concealment raised the possibility of selection bias.

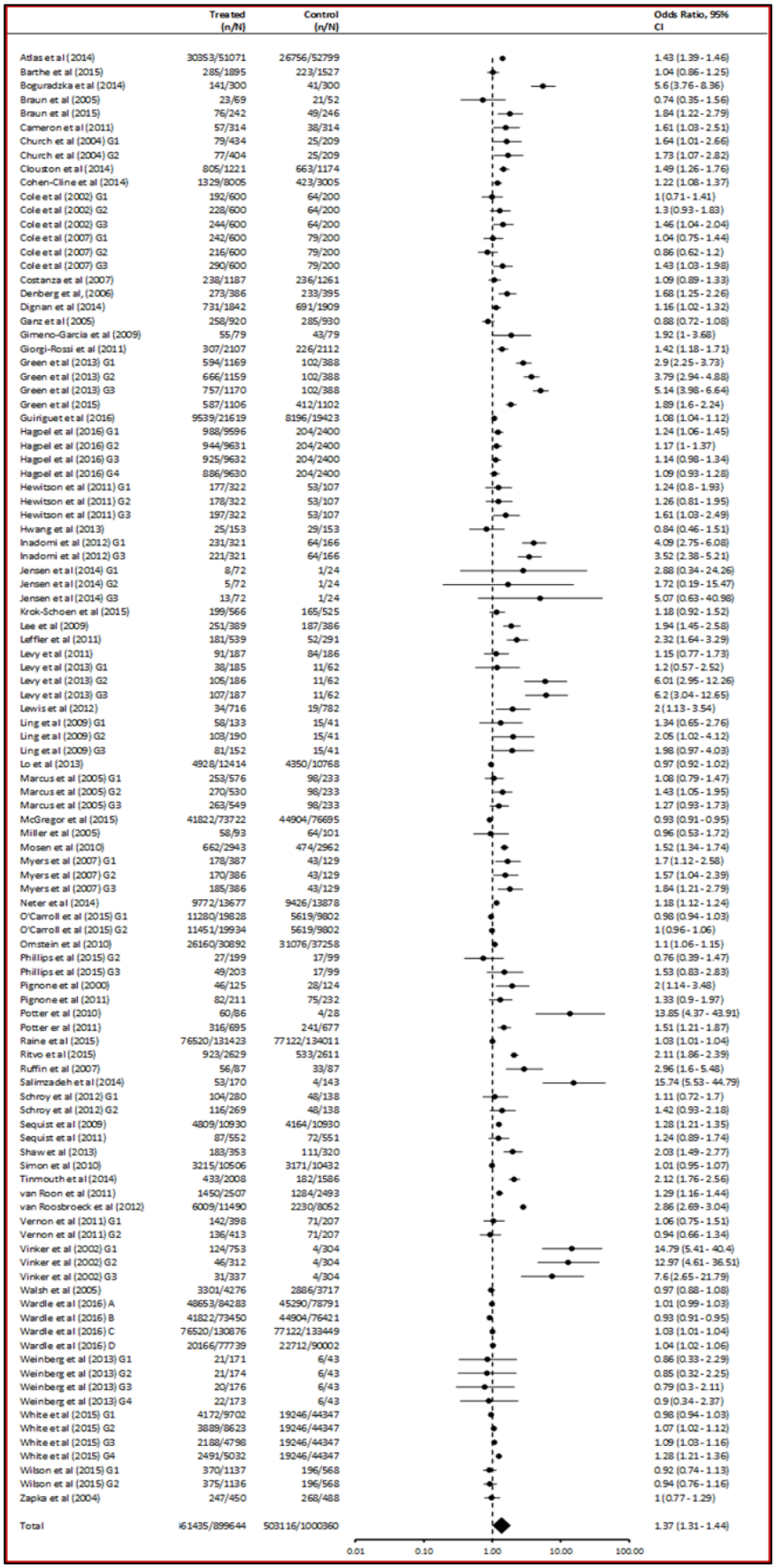
Appendix 2.9. Comparative effectiveness of health interventions to increase CRC screening uptake across samples.



Appendix 2.10. Effect of health interventions on CRC uptake in low SES populations.



Appendix 2.11. Effect of health interventions on CRC uptake in non-low SES populations



Appendix 2.12. Confidence intervals calculation for proportions

a) Full sample Intervention Condition

In order to determine the confidence interval for the proportion of people that were screened in the *Full Sample* intervention group, the following equation was used:

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Where $\hat{p}$ is the sample proportion, *n* is the total number of observations (i.e. sample size), and z^* is a multiplier number derived from the normal curve that determines the *level of confidence*; here z^*=1.96 in order to obtain a 95% CIs.

- Sample proportion calculation:

$\hat{p}$ = 469,933/919,037 = 0.5113

- Margin error calculation:

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{0.5113\ \frac{(1-0.5113)}{919{,}037}} = \sqrt{0.5113\ \frac{0.4887}{919{,}037}} = \sqrt{0.5113 * 0.00000053} = \sqrt{0.00000027} = 0.00052$$

The margin of error is, z^* multiplied by 0.00052. Therefore the margin of error is 1.96 * 0.00052 = 0.0010.The 95% CI for the proportion of people that obtained screening in the *non-low SES* control group is 0.5113 (or 51.13%) plus or minus 0.0010. The lower limit of the interval is 0.5113 - 0.0010 = 0.5103 or 51.03% and the upper limit is 0.5113 + 0.0010 = 0.5123 or 51.23%.

b) Full sample Control Condition

In order to determine the confidence interval for the proportion of people that were screened in the *Full Sample* control group, the following equation was used:

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Where $\hat{p}$ is the sample proportion, *n* is the total number of observations (i.e. sample size), and z^* is a multiplier number derived from the normal curve that determines the *level of confidence*; here z^*=1.96 in order to obtain a 95% CIs.

- Sample proportion calculation:

$\hat{p}$ = 509,913/1,022,128 = 0.4988

- Margin error calculation:

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{0.4988\ \frac{(1-0.4988)}{1{,}022{,}128}} = \sqrt{0.4988\ \frac{0.5011}{1{,}022{,}128}} = \sqrt{0.4988 * 0.00000049} = \sqrt{0.00000024} = 0.00048$$

The margin of error is, z^* multiplied by 0.00048. Therefore the margin of error is 1.96 * 0.00048 = 0.00094.The 95% CI for the proportion of people that obtained screening in the *non-low SES* control group is 0.4988 (or 50.29%) plus or minus 0.00094. The lower limit of the interval is 0.4988 - 0.00094 = 0.49786 or 49.78% and the upper limit is 0.4988 + 0.00094 = 0.49974 or 49.97%.

c) Non-low SES Intervention Condition

In order to determine the confidence interval for the proportion of people that were screened in the *Full Sample* intervention group, the following equation was used:

$$\hat{p}\ \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Where $\hat{p}$ is the sample proportion, *n* is the total number of observations (i.e. sample size), and z^* is a multiplier number derived from the normal curve that determines the *level of confidence*; here z^*=1.96 in order to obtain a 95% CIs.

- Sample proportion calculation:

$\hat{p}$ = 461,435/899,644 = 0.5129

- Margin error calculation:

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{0.5129\ \frac{(1-0.5129)}{899{,}644}} = \sqrt{0.5129\ \frac{0.4871}{899{,}644}} = \sqrt{0.5129 * 0.00000054} = \sqrt{0.00000028} = 0.000529$$

The margin of error is, z^* multiplied by 0.000529. Therefore the margin of error is 1.96 * 0.000529 = 0.00103.The 95% CI for the proportion of people that obtained screening in the *non-low SES* control group is 0.5129 (or 51.29%) plus or minus 0.00103. The lower limit of the interval is 0.5129 - 0.00103 = 0.5127 or 51.27% and the upper limit is 0.5129 + 0.00103 = 0.5130 or 51.30%.

d) Non-low SES control condition

In order to determine the confidence interval for the proportion of people that were screened in the *non-low SES* control group, the following equation was used:

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Where $\hat{p}$ is the sample proportion, *n* is the total number of observations (i.e. sample size), and z^* is a multiplier number derived from the normal curve that determines the *level of confidence*; here z^*=1.96 in order to obtain a 95% CIs.

- Sample proportion calculation:

$\hat{p}$ = 503,081/1,000,360 = 0.5029

- Margin error calculation:

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{0.5029\ \frac{(1-0.5029)}{1{,}000{,}360}} = \sqrt{0.5029\ \frac{0.4971}{1{,}000{,}360}} = \sqrt{0.5029 * 0.00000050} = \sqrt{0.00000025} = 0.0005$$

The margin of error is, z^* multiplied by 0.0005. Therefore the margin of error is 1.96 * 0.0005 = 0.00098.The 95% CI for the proportion of people that obtained screening in the *non-low SES* control group is 0.5029 (or 50.29%) plus or minus 0.00098 (rounded to 0.001 or 0.1%). The lower limit of the interval is 0.5029 - 0.001=0.5019 or 50.19% and the upper limit is 0.5029 + 0.001 = 0.5039 or 50.39%.

e) Low SES intervention condition

The same equation was applied for calculating the proportion of people that were screened in the *low SES* intervention group:

- Sample proportion calculation:

$\hat{p}$ = 8,498/19,393 = 0.4380

- Margin error calculation:

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{0.4380\ \frac{(1-0.4380)}{19{,}393}} = \sqrt{0.4380\ \frac{0.560}{19{,}393}} = \sqrt{0.4380 * 0.00002888} = \sqrt{0.00001265} = 0.0035$$

The margin of error is, z^* multiplied by 0.0035. Therefore the margin of error is 1.96 * 0.0035 = 0.00686. The 95% CI for the proportion of people that

obtained screening in the *low SES* intervention group is 0.4380 (or 43.80%) plus or minus 0.00686 (rounded to 0.0069 or 0.69%). The lower limit of the interval is 0.4380 - 0.0069 = 0.4311 or 43.11% and the upper limit is 0.4380 + 0.0069 = 0.4449 or 44.49%.

f) Low SES Control condition

The same equation was applied for calculating the proportion of people that were screened in the *low SES* control group:

- Sample proportion calculation:

  $\hat{p}$ = 6,797/21,768 = 0.3122

- Margin error calculation:

$$\sqrt{\frac{\hat{p}(1-\hat{p})}{n}} = \sqrt{0.3122\ \frac{(1-0.3122)}{21{,}768}} = \sqrt{0.3122\ \frac{0.6878}{21{,}768}} = \sqrt{0.3122 * 0.0000316} = \sqrt{0.00000986} = 0.00314$$

The margin of error is, z^* multiplied by 0.00314. Therefore the margin of error is 1.96 * 0.00314 = 0.00615. The 95% CI for the proportion of people that obtained screening in the *low SES* intervention group is 0.3122 (or 31.22%) plus or minus 0.00615. The lower limit of the interval is 0.3122 - 0.00615 = 0.3060 or 30.60% and the upper limit is 0.3122 + 0.00615 = 0.3183 or 31.83%.

Appendix 2.13. Correlation analyses to assess potential confounds among categorical moderator variables.

1) FULL SAMPLE CORRELATION ANALYSIS (*k* = 152)

- There was a significant, negative correlation between 'free healthcare system' and 'in person/mixed contact', r = -.219, k = 152, p = .007
- There was a significant, positive correlation between 'free healthcare system' and individual delivery, r =.170, k = 152, p = .036
- There was a significant, negative correlation between 'free healthcare system' and 'delivered by a person', r = -.370, k = 152, p < 0.001
- There was a significant, positive correlation between 'free healthcare' and 'single technique' r = .294, k = 152, p < 0.001
- There was a significant, positive correlation between 'free healthcare' and 'non endoscopic screening', r = 684, k = .152, p <0.001
- There was a significant negative correlation between 'in person/mixed contact' and individual delivery, r = -.501, k = 152, p < 0.001
- There was a significant, positive correlation between 'in person/mixed contact' and 'delivered by a person', r = .393, k = 152, p < 0.001
- There was a significant, positive correlation between 'in person/mixed contact' and 'community setting', r = .232, k = 152, p = .004
- There was a significant, negative correlation between 'in person/mixed contact' and 'non endoscopic screening', r = -.173, k = 152, p = .033
- There was a significant, negative correlation between 'in person/mixed contact' and 'objective assessment', r = -.328, k = 140, p < 0.001
- There was a significant, positive correlation between 'in person/mixed contact' and 'high/unclear bias', r =.210, k = 152, p =.009
- There was a significant, negative correlation between 'individual delivery' and 'delivered by person', r = -.330, k = 152, p < 0.001
- There was a significant, positive correlation between 'individual delivery' and 'objective assessment, r =.178, k = 140, p =.036
- There was a significant, negative correlation between 'individual delivery' and 'high/unclear bias', r = -.167, k = 152, p =.039
- There was a significant negative correlation between ' delivered by a person' and 'single technique', r = -.245, k = 152, p =.002
- There was a significant, positive correlation between 'delivered by a person' and 'community setting', r =.166, k = 152, p =.041
- There was a significant, negative correlation between 'delivered by a person' and 'non endoscopic screening', r =-.291, k = 152, p <.001
- There was a significant, negative correlation between 'delivered by a person' and 'objective assessment', r = -.236, k = 140, p =.005

- There was a significant, positive correlation between ‘delivered by a person’ and ‘high/unclear bias’, r =.162, *k* = 152, *p* =.046
- There was a significant, negative correlation between ‘single technique’ and ‘reminders’, *r* = -.191, *k* = 152, *p* =.018
- There was a significant, positive correlation between ‘community setting’ and ‘in person/mixed contact’, *r* =.232, *k* = 152, *p* =.004
- There was a significant, positive correlation between ‘community setting’ and ‘delivered by person’, *r* =.166, *k* = 152, *p* =.041
- There was a significant, negative correlation between ‘community setting’ and ‘objective assessment’, *r* = -.336, *k* = 140, *p* < 0.001
- There was a significant, positive correlation between ‘non endoscopic screening’ and ‘objective assessment, *r* =.219, *k* = 140, *p* =.009
- There was a significant, negative correlation between ‘objective assessment’ and ‘high/unclear’ bias, *r* = -.219, *k* = 140, *p* =.009

2) NON-LOW SES CORRELATION ANALYSIS (*k* = 105)

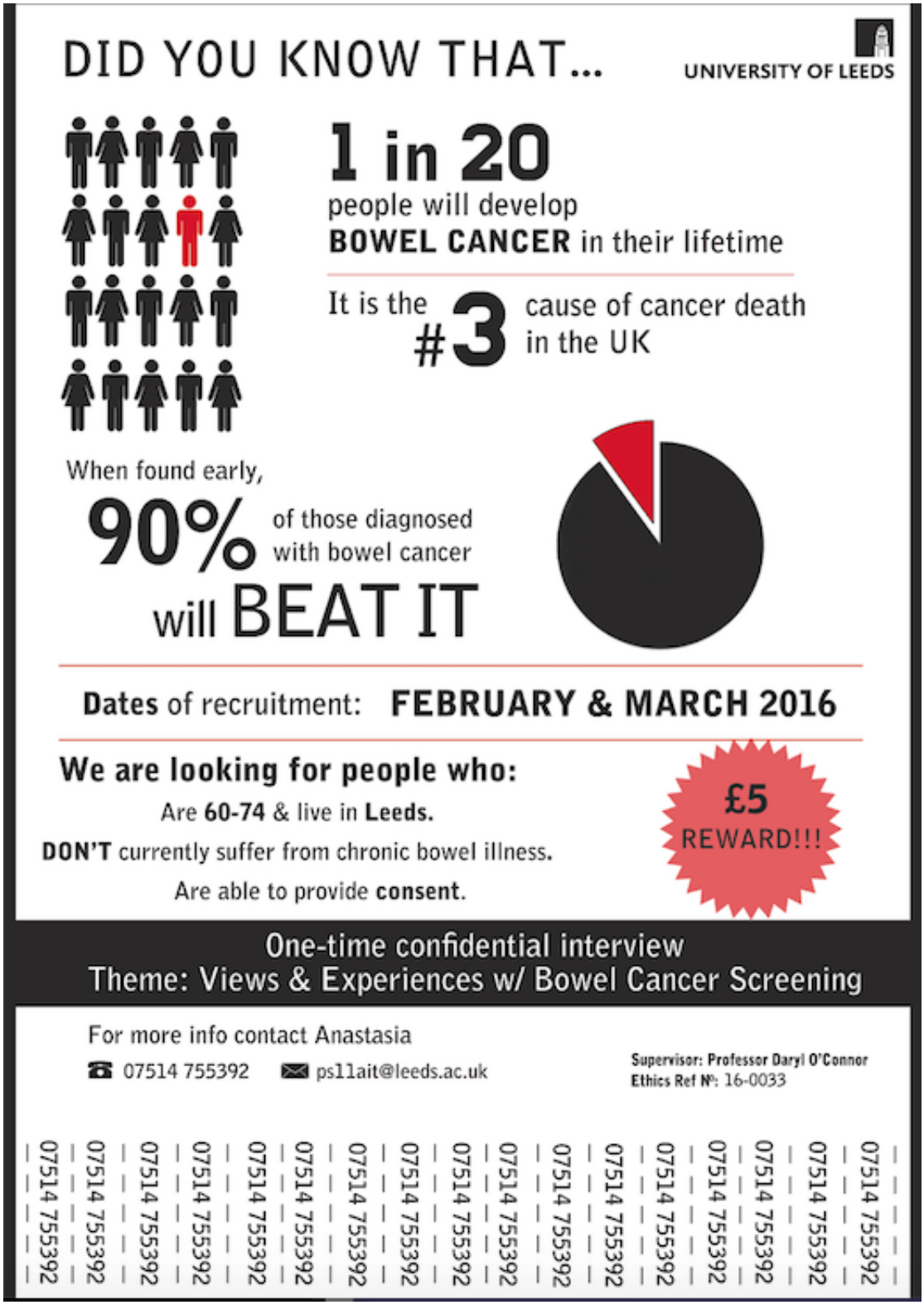
- There was a significant, negative correlation between ‘free healthcare system’ and ‘in person/mixed contact’, *r* =-.245, *k* = 105, *p* =.012
- There was a significant, positive correlation between ‘free healthcare system’ and ‘individual delivery, *r* = .223, *k* = 105, *p* =.022
- There was a significant, negative correlation between ‘free healthcare system’ and ‘delivered by a person’, *r* = -.286, *k* = 105, *p* =.003
- There was a significant, positive correlation between ‘free healthcare system’ and ‘single technique’, *r* =.305, *k* = 105, *p* =.002
- There was a significant, positive correlation between ‘free healthcare system’ and ‘non endoscopic screening’, *r* =.748, *k* = 105, *p* < 0.001
- There was a significant, negative correlation between ‘in person/mixed contact’ and ‘individual delivery’, *r* = -.524, *k* = 105, *p* < 0.001
- There was a significant, positive correlation between ‘in person/mixed contact’ and ‘delivered by a person’, *r* =.368, *k* = 105, *p* < 0.001
- There was a significant, negative correlation between ‘in person/mixed contact’ and ‘single technique’, *r* = -.199, *k* = 105, *p* =.042
- There was a significant, negative correlation between ‘in person/mixed contact’ and ‘non endoscopic screening’, *r* = -.268, *k* = 105, *p* =.006
- There was a significant, negative correlation between ‘in person/mixed contact’ and ‘objective assessment’, *r* = -.338, *k* = 96, *p* =.001
- There was a significant, negative correlation between ‘individual delivery’ and ‘delivered by a person’, *r* = -.425, *k* = 105, *p* < 0.001
- There was a significant, negative correlation between ‘delivered by a person’ and ‘single technique’, *r* = -.227, *k* = 105, *p* =.020
- There was a significant, negative correlation between ‘ delivered by a person’ and ‘non endoscopic screening’, *r* = -.313, *k* = 105, *p* =.001
- There was a significant, negative correlation between ‘community setting’ and ‘objective assessment’, *r* = -.349, *k* = 96, *p* < 0.001

- There was a significant, positive correlation between ‘community setting’ and ‘high/unclear bias, *r* =.250, *k* = 105, *p* =.010
- There was a significant, negative relationship between ‘objective assessment’ and ‘high/unclear bias’, *r* = -.206, *k* = 96, *p* =.044

3) LOW SES CORRELATION ANALYSIS (*k* = 47)

- There was a significant, positive correlation between ‘free healthcare’ and ‘non endoscopic screening’, *r* =.290, *k* = 47, *p* =.048
- There was a significant, negative correlation between ‘in person/mixed contact’ and ‘individual delivery’, *r* = -.448, *k* = 47, *p* =.002
- There was a significant, positive correlation between ‘in person/mixed contact’ and ‘delivered by a person’, *r* = .360, *k* = 47, *p* =.013
- There was a significant, positive correlation between ‘in person/mixed contact’ and ‘community setting’, *r* =.415, *k* = 47, *p* =.004
- There was a significant, negative correlation between ‘in person/mixed contact’ and ‘moderate/high use of theory’, *r* = -.671, *k* = 11, *p* =.024
- There was a significant, positive correlation between ‘individual delivery’ and ‘objective assessment’, *r* =.314, *k* = 44, *p* =.022
- There was a significant, positive correlation between ‘delivered by a person’ and ‘community setting’, *r* =.418, *k* = 47, *p* =.003
- There was a significant, negative correlation between ‘single technique’ and ‘reminders’, *r* = -.363, *k* = 47, *p* =.012

Appendix 3.1. Poster for Participant Recruitment



Appendix 3.2. Participant Information Sheet

Participant Information Sheet (15-12-2015, version 2)

Factors that Influence Participation in Bowel Cancer Screening

Researcher: Anastasia Tsipa, School of Psychology, University of Leeds, UK
Email: ps11ait@leeds.ac.uk, **Phone number**: 0113 343 9196
Supervisors: Professor Daryl O'Connor, Professor Mark Conner & Dr Fiona Day
Supervisors' Emails: d.b.oconnor@leeds@leeds.ac.uk, m.t.conner@leeds.ac.uk, F.day@nhs.net
Address: School of Psychology, University of Leeds, Leeds, LS2 9JT
Ethics approval no: 16-0022
Date of ethical approval: 04/02/2016

Hi! My name is Anastasia and I am a doctoral research student in the School of Psychology at the University of Leeds. I would like to invite you to take part in my research study, which is about participation in bowel cancer screening. If you are interested, please read the information below carefully and do not hesitate to contact me if you would like to ask any questions regarding the study. The current research is being organised and funded by the University of Leeds in conjunction with the Leeds City Council.

What is the purpose of this study?

The purpose of this research is to understand what factors may influence people's decision to take part in the bowel cancer screening programme. We are interested in hearing your thoughts and opinions regarding the home stool blood test, as well as your input on how the screening programme could be improved in the future. We hope that the project will feed into improving opportunities for people of the general public to engage with bowel cancer screening, and also inform a range of policy and strategy suggestions relevant to improving the delivery of the bowel cancer screening programme as a whole.

Why have I been invited to take part?

You are being invited to take part in this research because you live in Leeds, you are registered with a GP, you are aged between 60-74 years and you don't suffer from a chronic bowel illness. Regardless of whether you have completed the home stool blood test or not we want to hear from you! If you fit all the criteria mentioned above then you are suited to take part in this study.

What does the study involve?

We want to know more about your personal experience with the bowel cancer screening process and specifically the home stool blood test. There are two phases to this study if you wish to get involved!

During the first phase, I will kindly ask you to fill in a brief demographic questionnaire that has been given to you along with this information sheet. Filling in this questionnaire will confirm whether you are eligible to take part in this research. If you haven't received this questionnaire, or simply can't find it, you will be able to obtain one either by asking a member of staff at the reception of your community centre, or you can ask to receive it through the post by directly contacting me on ***0113 343 9196.*** Before we start chatting on the phone I will state my name (Anastasia Tsipa), the name of my supervisor (Professor Daryl O'Connor), and the number of ethical approval. I might also ask you to tell me where you saw the study being advertised. When filling in the demographic questionnaire you will be asked to provide your contact details (an email or a telephone number where I can reach you) so that I can be in touch with you at a subsequent time and tell you about the second phase of the research.

If you are eligible and happy to take part then I will contact you to arrange an informal one-to-one interview, which is the second phase of the study. The interview will take place in a quiet, public venue familiar to you (tea will be offered!). I will ask you a series of questions regarding your views and opinions about the bowel cancer screening programme, the home test screening kit and your participation to bowel cancer screening. There are no right or wrong answers. The discussion will last about 30-45 minutes and it will be audio-recorded with your permission. This is to help me remember all the interview information correctly. To thank you for your participation, after the interview is completed you will be given £5. I will also need you to sign a receipt to confirm that you received the £5.

Will my taking part in this project be kept confidential?

The recordings of the interview will be typed up into a transcript, which will be anonymised. This means that all identifying details will either be changed or removed, e.g., names of places, people and details of very specific events. Transcription of the recordings will be done by the researcher, and the content of the interview will be kept confidential. Only the researcher will have access to this information. The information from the interview will then be analysed and used to complete the final report. Any direct quotations or comments that are used in the final report or any subsequent publications will be anonymised. Audio-recordings of the discussion will be kept on a secure university computer, locked with a username and password. Audio-recordings from the interviews, as well as the transcriptions and demographic questionnaires, will be destroyed on completion of the research project.

Do I have to take part?

No – it is entirely up to you to decide. If you are interested in participating in the study, I will go through this information sheet with you again before the interview to make sure you understand what is involved. You can ask me any questions before you decide: you can call or email me or ask me on that day of the interview. If you choose to take part you are free to stop the discussion at any point. If you want to stop the discussion and leave the interview you do not have to give a reason. There are no penalties for leaving the interview.

Are there any risks in taking part?

I do not expect there to be any significant risks in taking part. In the unlikely case you do find any of the questions I ask you uncomfortable or upsetting, please remember that you are under no obligation to answer that question and you are free to leave at any point without providing a reason.

Are there any benefits in taking part?

Taking part might be interesting and give you the opportunity to talk with someone who has conducted extensive research on this topic. Furthermore, if you decide to take part you are contributing towards the advancement of scientific research, you are taking an active role in your own healthcare and you are having your own views expressed and included in research. Most importantly, this research aims to provide valuable insight into how to improve the delivery of the national bowel cancer, screening programme, so your participation is extremely important and voicing your opinion will help me reach this goal.

What will happen to the information collected?

All the collected information will be analysed in order to identify common and uncommon opinions and views regarding the home test screening kit. A final report of the research findings will be produced and presented to the Prevention and Early Diagnosis of Cancer group at Leeds City Council and the Health and Social Psychology Research group at Leeds University. The final report will form part of my doctoral thesis. Findings may also be used in subsequent publications and conference presentations.

Ethics

This research has been approved by the Faculty of Medicine and Health review panel, which is monitored by the University of Leeds Ethics Committee. The ethical guidelines for this research have been set out by the British Psychological Society code of ethics.

More information or complaints?

If you have any complaints about my contacting you, or anything that happens in the discussion, please contact my supervisor Professor Daryl O'Connor (project lead) by email on: d.b.oconnor@leeds@leeds.ac.uk or phone: +44 (0)113 343 5727.

I hope you have enough information about my study, but if you would like to ask any questions please do not hesitate to contact me: ps11ait@leeds.ac.uk or 0113 343 9196.

Thank you for considering taking part in this study.
Anastasia Tsipa

Appendix 3.3. Participant Consent Form

Consent Form

Research title: Factors that Influence Participation in Bowel Cancer Screening: A Qualitative Analysis

Researcher: Anastasia Tsipa, School of Psychology, University of Leeds, UK
Email: ps11ait@leeds.ac.uk, **Phone number**: 0113 343 9196
Supervisors: Professor Daryl O'Connor, Professor Mark Conner & Dr Fiona Day
Supervisors' Emails: d.b.oconnor@leeds@leeds.ac.uk, m.t.conner@leeds.ac.uk, F.day@nhs.net
Address: School of Psychology, University of Leeds, Leeds, LS2 9JT
Ethics approval no: 16-0022
Date of ethical approval: 04/02/2016
The purpose of this form is to make sure that you are happy to take part in the research and know what is involved. If you are happy to sign this sheet, please confirm each statement by putting your initials in the associated box.

I am between 60-74 years old	
I am a permanent resident of Leeds	
To the best of my knowledge, I do not suffer from a chronic bowel illness (including ulcerative colitis, Crohn's syndrome, irritable bowel disorder, bowel cancer)	
I am able to travel to my local community centre	

I have read the participant information sheet (dated 15-12-2015) or had all the information explained to me by the researcher.	
I have read and understood the information sheet (dated 15-12-2015)	
I have had the opportunity to ask questions and to discuss the study.	
I have received satisfactory answers to all of my questions.	
I have received enough information about the study.	
I understand that even after completing this consent form I can leave from the discussion at any time without giving a reason.	
I understand that once I take part can only withdraw my responses within a strict time period of one month	
I understand that I am free to choose not to answer a question without having to give a reason.	
I understand that all my responses will be kept confidential unless I disclose information which poses a risk to myself or others	
I agree to the discussion being recorded (e.g., audio-recorded).	
I grant permission for my data to be shared with other researchers on the condition that my anonymity will be maintained.	
I grant permission for extracts from the discussion to be used in reports of the research (such as journal publications and conference presentations) on the understanding that my anonymity	

will be maintained.	
I understand that my personal information, whether paper or electronic, will be stored with adequate security measures and only stored for as long as absolutely necessary	
I agree to take part in this study.	

Unique participant code: _____ (if you have forgotten what this is, follow instructions below)

Step 1: Write down the **second** letter of your **mother's maiden name**

_____

Step 2: Write down the **last** letter of the **county** in which you were born

_____

Step 3: Write down the **last** digit of your **home telephone number**

_____

Step 4: Write down the **first** letter of the **month** you were born

_____

Step 5: Combine it all together to create your personal 4-digit code_____

For example, Maggie Smith, whose mother's maiden name is W**i**lliams, was born in Esse**x**, her home telephone number is 0113 333 333**3** and was born in **J**une would create the code: **IX3J**

Participant signature: _____

Date: _____

Name of researcher: Anastasia Tsipa

Researcher signature:

Date:

Ethics Approval: _____

Ethics Date: _____

Supervisor: Professor Daryl O'Connor

Contact Details: School of Psychology, University of Leeds

Email: D.B.O'Connor@leeds.ac.uk

Appendix 3.4. Pre-screening Demographic Questionnaire

Demographic Questionnaire

Research Title: Factors that Influence Participation in Bowel Cancer Screening

Researcher: Anastasia Tsipa, School of Psychology, University of Leeds, UK
Email: ps11ait@leeds.ac.uk, **Phone number**: 0113 343 9196
Supervisors: Professor Daryl O'Connor, Professor Mark Conner & Dr Fiona Day
Supervisors' Emails: d.b.oconnor@leeds@leeds.ac.uk, m.t.conner@leeds.ac.uk, F.day@nhs.net
Address: School of Psychology, University of Leeds, Leeds, LS2 9JT
Ethics approval no: 16-0022
Date of ethical approval: 04/02/2016

Thank you for agreeing to participate in this study! Before filling out the questionnaire, please follow the instructions below in order to create a participant code unique to you. This is done to make sure that any information you share with us is completely confidential.

HOW TO CREATE YOUR UNIQUE CODE

Follow the following 5 steps carefully

Step 1: Write down the **second** letter of your **mother's maiden name**

_____

Step 2: Write down the **last** letter of the **county** in which you were born

_____

Step 3: Write down the **last** digit of your **home telephone number**

_____

Step 4: Write down the **first** letter of the **month** you were born

_____

Step 5: Combine it all together to create your personal 4-digit code_____

For example, Maggie Smith, whose mother's maiden name is W**i**lliams, was born in Esse**x**, her home telephone number is 0113 333 333**3** and was born in **J**une would create the code: **IX3J**

Contact details (phone/email): _____

NOTE: Responses to any of the following questions is optional. Please feel free to decide which sections you wish to complete.

1. Ethnicity (Please select one)
   - **A. White**
   - ☐ Welsh/English/Scottish/Northern Irish/British
   - ☐ Irish
   - ☐ Gypsy or Irish traveller
   - ☐ Any other White background (Please specify)

     _____

   - **B. Asian/Asian British**
   - ☐ Indian
   - ☐ Pakistani
   - ☐ Bangladeshi
   - ☐ Chinese

- ☐ Any other Asian background (Please specify)

_____

C. Black/African/Caribbean/Black British

- ☐ African
- ☐ Caribbean
- ☐ Any other Black/African/Caribbean background (Please specify)

_____

D. Mixed/Multiple Ethnic Groups

- ☐ White & Black Caribbean
- ☐ White & Black African
- ☐ White & Asian
- ☐ Any other Mixed/Multiple ethnic background (Please specify)

_____

E. Other Ethnic Group

- ☐ Arab
- ☐ Any other ethnic group (Please specify)

_____

- ☐ I would rather not say

2. Age (Please select one)

- ☐ 59 or under
- ☐ 60-67
- ☐ 68-74
- ☐ 75 or older
- ☐ I would rather not say

3. Gender (Please select one)

- ☐ Female
- ☐ Male
- ☐ I would rather not say

4. Primary language (Please select one)

- ☐ English
- ☐ Polish
- ☐ Punjabi
- ☐ Hindustani
- ☐ Bengali
- ☐ Gujarati
- ☐ Arabic
- ☐ Other (Please Specify)

_____

- ☐ I would rather not say

5. Are you a permanent resident of Leeds? (Please select one)

- ☐ Yes
- ☐ No
- ☐ I would rather not say

6. If you responded ***Yes*** to Question 5, please write down your postcode in the space provided

My postcode: _____

 I would rather not say

7. Are you registered with a GP? (Please select one)

 Yes
 No
 I would rather not say

8. Have you ever been diagnosed with a gastrointestinal disorder?

A. **If *yes***, please check any that apply from the following list:

 Ulcerative colitis
 Crohn's disease
 Irritable bowel syndrome (IBD)
 Bowel cancer
 Other gastrointestinal disorder (Please specify)

_____

 I would rather not say

B. ☐ **No**, to the best of my knowledge I haven't been diagnosed with a gastrointestinal disorder

9. Do you have a family history of bowel cancer? (Please select one)

Note. This refers to you having close relative (e.g., parent, sibling) been diagnosed with bowel cancer, to the best of your knowledge

 Yes
 No
 I would rather not say

10. Have you received an invitation to participate in bowel cancer screening? (Please select one)

 Yes
 No
 I'm not sure

11. Have you ever used the home screening kit for bowel cancer? (Please select one)

 Yes
 No
 I would rather not say

12. When was the last time you used the home screening kit for bowel cancer? (Please select one)

 Within the last 2 years
 More than 2 years ago
 Not applicable
 I would rather not say

Thank you!

Appendix 3.5. Interview Schedule

- Introduce myself, tell them a bit about the background of my research.
- Explain the specific study in detail and the stages involved (demographic questionnaire, interview).
- Ask if they have read the information sheet. If not, give time to read information sheet. Allow time to respond to questions/clarify any issues.
- Explain that interviews will be audio-recorded and respond to any questions/clarify an issues. Emphasise that data will be kept confidential and anonymous.
- Reaffirm there are no right or wrong answers and that I am only interested in their views and thoughts about the bowel cancer screening test kit
- Ask if there are any further questions
- Obtain signed consent.
- Record interview number at the start of the interview.

Opening questions:

- Are you a permanent resident of Leeds?
- Are you registered with a GP?
- And would you say you see your GP often?
- Do you have any chronic health problems or any conditions you are dealing with at the moment?
- Do you have a family history of cancer?
- Have you ever received an invitation from the NHS for bowel cancer screening?
- Have you ever discussed the screening kit with your GP?
- Are you familiar with the kit you need to use for the bowel screening test? (if people have done the test then a series of questions are asked regarding their experience, their views, their feelings, their thoughts, suggestions/recommendations etc. If they are not aware of the screening or have received it and haven't done it, discuss with them the process showing them the NHS leaflet and the demo kit, describe the steps they need to take to complete it and gauge initial reactions to the kit, whether they think it is

important, their views on prevention, burden of disease, maintaining good health etc.)

Main interview questions:

- What is your understanding/what do you know about bowel cancer?
- What do you know about the home test kit for bowel cancer?
- Why do you think you have been invited to complete this test kit?
- Did you attempt to complete the test?
- What was your feeling about completing the test?
- Could you briefly describe the steps you took to complete the test?
- When did you complete the test? How many times?
- Did you understand the procedure of completing the test?
- What did you think of the instructions?
- How did you find the process for completing the test? (for repeat screeners: did you find it harder or easier the very first time you did the test in comparison to subsequent times when you used the test?)
- What would have made the screening procedure easier? (if participant has indicated they found it complicated)
- Were there any practical difficulties with completing the test?
- What do you think about a one-stool sample kit compared to the three-sample kit you have used?
- If you did not complete the test or did it halfway or did not return it, why did you choose not to?
- What was the main thing that put you off completing the test (for non-screeners) /motivated you to do the test (for screeners)?
- What were you feeling after you completed the kit?
- How did you feel whilst waiting for the results?
- Do you take part in any other screening programmes?
- Generally would you say you keep on top of medical tests?
- Do you think screening is important? Is so, why? If not, why not?
- Would you say it is a priority for you to be healthy?
- Do you believe prevention of disease is important? Why or why not?
- Before you received the bowel screening kit had you heard about it?

- Have you discussed about the bowel screening kit with people close to you?
- How do you feel talking about this topic with others?
- Are you likely to talk with other people about health problems or concerns you might have? If so, why? If not, why not?
- Do you think that bowel cancer is a topic discussed openly?
- Overall how would you describe the experience of completing the kit?
- Do you think you will participate in bowel cancer screening in the future?
- Which aspects of the home test did you like?
- What do you think would increase the chances of you completing the kit?
- Do you have any suggestions of how uptake could be improved?
- How do you think awareness about the bowel cancer screening kit could be raised?
- Do you think it is important to involve communities?
- What would you like to see happen to raise awareness on this topic in your community?
- What improvements/changes would you like to see in the screening programme?
- Are there any questions you would like to ask or something you would like me to clarify?

Closure of interview:

- Is there any questions/concerns you would like me to clarify?
- Would you like to know anything further about my background?
- Would you like to know more about the study findings once the research is completed?
- Do you know of anybody else that would be interested in taking part?

Thank participants for their participation in the study.

Appendix 3.6. Image of gFOBT screening kit

Appendix 3.7. Critical Appraisal Tool for Interview-Based Qualitative Studies in Psychotherapy/Applied Psychology.

Evaluation Criteria Presence/Applicability	(Yes, No, N/A)*	Notes	Score
1. Context and purpose	-		
Does the paper:	-		
a. review relevant literature, including previous research studies?	Yes	pp.111-115 Note. Relevant literature also outlined in Chapter 1 of the thesis.	+
b. present a rationale for the conduct of the study?	Yes	pp.114-115 Note. Rationale for the need to identify barriers and facilitators to screening also outline in Chapter 1 of the thesis.	+
c. state explicitly its focus/aims/research questions?	Yes	pp.115-116	+
2. Recruitment			
a. Are the selection criteria, and any deviations from them, described?	Yes	pp.116-117	+
b. Is/are the method(s) of approaching participants reported?	Yes	pp. 118-119	+
c. Is there any discussion about potential participants who did not finally take part, e.g., reasons for non-participation, comparison with the sample or target population?	No		-
d. Did the majority of the potential participants qualified for taking part in the study actually take part?	Yes		+
e. Did the selection criteria and recruitment method enable access to a sample that allowed for the aims of the study to be investigated?	Yes	pp.115-117	+
Consider: i. the fit between the target population and the aims of the study	-		
ii. any bias inherited in the	-		

recruitment method e.g., retrospective methods may attract only a subgroup of the target population—those with a high interest in or strong feelings toward the research topic			
iii. how the final sample differs from the target population	-		
f. Is the sample composition consistent with the methodology used?	Yes	pp.115-124	+
Consider: i. the diversity and size of the sample in relation to any explicit requirements of the methodology used, e.g., requirements for a theoretical sample in GT and a homogenous sample in IPA	-		
ii. implict or explicit rationale for any deviations from the above requirements	-		
3. Situating the sample	**-**		
Does the paper report:	-		
a. participants' age and gender?	Yes	pp. 126-127	+
b. participants' difficulties/presenting issues?	*N/A*		*N/A*
c. the grade or degree of experience that the therapist/ the professional delivering the intervention had?	*N/A*		*N/A*
d. exactly when during/after participants' therapy/intervention the data was collected, e.g., a month after its completion?	*N/A*		*N/A*
e. any information about the recruitment setting(s)?			
f. the type and duration of the therapy/intervention, e.g., theoretical orientation of therapy, individual or group?	*N/A*		*N/A*
4. Data collection			
a. Is the interview as a method of data collection	Yes		+

compatible with the aims of the study?			
Consider: i. the purpose of other methods of data collection in QR such as observations, transcribed therapy sessions			
ii. differences between quantitative and qualitative research			
b. Does the paper report the questions/domains that guided data collection?	Yes	pp.117-118	+
c. Is the content of the interview questions consistent with the study aims?	Yes	p.120, pp. 414-416	+
d. Is the degree of the interview structure appropriate to the methodology used?	Yes	pp.117-120, pp. 414-416	+
Consider: i. technical and theoretical elements and aims of the methodology used, e.g., open-ended and semi-structured interviews are recommended in GT and Consensual Qualitative Research, respectively	-		
e. Does the paper report the exact form of the original data e.g., transcribed interviews, video recording?	Yes	p.120	+
f. Does the paper report any procedures for refining the data collection method(s), including a pilot study?	Yes	p.118	+
g. Was the data collection conducted at an optimal time?	*N/A*		*N/A*
Consider: the time of the interview in relation to the intervention e.g., one month to one year after therapy?			
h. Was the interviewer independent from the delivery of the intervention?	*N/A*		*N/A*
i. Was the data collection setting different from the clinic where the participants received therapy/the	*N/A*		*N/A*

intervention ?			
5. Analysis/Findings			
a. Does the paper report the different stages of the data analysis?	Yes	pp.120-125	+
b. Is the reported process of analysis consistent with the study methodology?	Yes	pp.120-125	+
Consider: i. a possible match between the steps of analysis required by the methodology and the those reported in the paper	-		
ii. appropriate use of language e.g. high-order themes are called categories in GT and superordinate themes in IPA	-		
c. Is there sufficient data presented?	Yes		+
Consider: For most themes are there in each theme:	-		
i. extracts from a few different participants if sample ≥ 8 or	-		
ii. extracts from half of the participants if sample < 8?	-		
d. Are the themes well grounded in the data?	Yes		+
Consider: i. the length and richness of the extracts	-		
ii. logical connection between data and findings	-		
e. Are any divergent/contradictory data presented?	Yes	e.g. views on FIT vs gFOBT, favourable views towards NHS vs medical mistrust	+
f. Is the final structure/frame produced by the analysis sufficiently synthesised?	Yes		+
Consider: i. not excessive overlap between themes is displayed	-		
ii. different levels of themes are presented, if appropriate	-		
iii. the themes are grouped in such a way that the relationships between them are displayed	-		
iv. the level of analysis required by each	-		

methodology, e.g., interrelations between categories is to be demonstrated in GT; a small number of dense superordinate themes is to be the final product in IPA			
g. Does the paper make consistent use of either actual numbers or phrases such as “the majority of the participants” to indicate the prevalence of emerging themes in the sampling corpus?	Yes		+
6. Auditability/Credibility	**-**		
Does the paper:	-		
a. mention the use of an audit trail?	No		-
b. use credibility checks?	No		-
c. check therapist’s/practitioner’s adherence to the therapy modality/intervention delivered?	*N/A*		*N/A*
d. Are the credibility methods used appropriate for the methodology of the study?	N/A		*N/A*
Consider: if the credibility methods violate any epistemological principles inherited in the methodology used. e.g., inter-rater reliability would violate the phenomenological principles of IPA	-		
7. Impact and value			
a. Does the paper link its findings to its aims/objectives/questions?	Yes	pp.174-181 Note. This is done in further depth in Chapter 5 (i.e., Discussion) .	+
b. Does the paper link its findings to the existing literature?	Yes	pp.174-181 Note. This is done in further depth in Chapter 5 (i.e., Discussion).	+
c. Do clinical, practical or wider implications emerge	Yes	pp.174-181 (e.g., “Indeed the role of	+

from the findings?		personal responsibility… motivate action to change.”).	
d. Do the findings increase our theoretical knowledge in the field?	No		-
e. Does the paper identify directions for future research?	Yes	pp.175-181 (e.g., p 180: “This is important information for consideration in the design of interventions…repeat participation.”) Note. Directions for future research are further discussed in Chapter 5.	+
f. Does the paper discuss its main limitations?	Yes	p.181	+
g. Is the reported transferability of the findings justifiable by the sample?	No		–
Consider: i. selection criteria, recruitment methods, sample composition	-		
h. Are the analytic claims consistent to the aims of the methodology used?	Yes		+
Consider: the conclusions drawn in relation to the purpose of the methodology, e.g., a paper using thematic analysis cannot claim that it has developed a theory as this would require GT	-		
8. Reflexivity:			
Have the researchers made disclosures regarding their:			
a. beliefs/assumptions about the under study phenomenon?	No		-
b. professional background/training?	No		-
c. relevant theoretical perspectives?	*No*		-
d. Have the researchers reflected on the impact of any of the above on the research process?	Yes (the bit that has been added)		+

e. Have the researchers referred to a reflective journal?	No		-
f. Have the researchers clarified what is their relationship with the participants (even if there is no relationship)?	No		-
9. Ethics			
Has the paper:			
a. kept information that could lead to the identification of participants to a minimum?	Yes	p.120	+
b. anonymised the service from which the data were collected?	N/A		*N/A*
c. reported that approval was granted by an appropriate ethical committee?	Yes	p.125	+
d. avoided the use of discriminatory language?	Yes		+
Have the researchers clarified:	-		
e. how they tried to ensure participants' welfare?; e.g., option for debriefing, excluding vulnerable individuals	No		-
f. how they tried to ensure confidentiality of data?	Yes	p.120	+
g. clarified whether informed consent was obtained	Yes	p.118	+
□Score (0-1)			

*__Yes__ Meets criterion.

__No__ Does not meet criterion/ Lack of sufficient information.

__N/A__ Criterion not applicable to the evaluated study.

Score = $\frac{\text{Total number of questions marked as Yes}}{56-(\text{Total number of N/A questions})}$.

Score = 34/56-10→34/46= 0.73 High quality

Appendix 4.1. Participant Information Sheet

Title of Research: Psychosocial Determinants of Bowel Cancer Screening Uptake

I would like to invite you to take part in a research study. Before you decide if you want to participate or not, you should understand what this research will involve. Please read the following information carefully. If you have any questions please do not hesitate to contact the researchers (you will find their contact details at the end of this page).

What is the purpose of the study?

This study aims to investigate the psychological and social factors that might influence bowel cancer screening uptake. It doesn't matter if you have done the bowel cancer screening or not – we want to hear from you either way!

All of the survey questions refer to doing the bowel cancer screening test that is sent to you by the NHS every 2 years. When we refer to the bowel cancer screening test we mean the home test kit that requires you to collect tiny stool samples on a special card on 3 separate days and then send it through the post to the screening laboratory to be tested. The purpose of this screening test is to pick up early signs of bowel cancer.

What will I have to do if I take part?

After reading this information sheet, if you choose to take part in this research you will first be given a consent form. This consent form requires you to agree to its conditions if you are to take part in the study. Then you will be asked to complete a short demographic questionnaire that will include some lifestyle questions and also some questions about your past screening behaviour. Then you will be asked a few questions that you should answer as truthfully as possible.
Don't think about your responses too much, there is no right or wrong answer to any of the questions. It will take around 15 to 20 minutes to respond to all the questions and there will be instructions on each page to guide you through the questionnaire.

Am I eligible to take part?

To take part you must:

1) **Be aged between 60 and 74 years**
2) **Live in the UK**
3) **Have access to the internet**

Are there any advantages or disadvantages to taking part?

You will have a chance to enter a prize draw to **win 1 of 4 £50 Amazon vouchers** at the end of the questionnaire.

Some of the information asked for in this research may be considered sensitive by some individuals. For example, you will be asked about the bowel screening kit and your screening experiences which some people might find unpleasant. If at any stage you become distressed by the content of the questionnaire, you may stop the study. Responses to all questions are optional and it is completely up to you to decide whether you want to respond or not. If you experience any distress during the survey you might find it helpful to contact the following support group for any general queries you have about bowel cancer and the screening process. If you have any questions or concerns about any aspect of bowel cancer or bowel cancer screening, the following

organisations can help: Beating Bowel Cancer: 08450 719301 or 020 8973 0011; Macmillan Cancer Support: 0808 808 00 00; Cancer Research UK: 0808 800 4040.

You may withdraw your data at any time, without reason or consequence, by emailing the researchers with your unique Participant ID code, which you will create once you begin the survey. You can withdraw your data until 30/07/2017. At that point data analysis will begin and you will no longer be able to withdraw your data. Once you have created your Unique Participant ID code, please keep a note of it as you will need it if you wish to withdraw from the study.

Will my taking part in the study be kept confidential?

All data collected in this study is completely anonymous and confidential. Data will be stored for a maximum of 5 years before being destroyed, but your confidentiality will remain throughout this time. Only the researchers will have access to your data but they will not be able to identify you.

What will happen to the results of the research study?

Results from this study may be published in a peer-reviewed journal (open access where possible) and in the academic work of the researchers. No participants will be identifiable in such reports.

Who is organising or funding this research?

The present research is funded by Leeds City Council and has been granted ethical approval by the School of Psychology Ethical Review Committee, University of Leeds, (ethical approval reference number: 17-0123, ethical approval date: 10-04-2017).

Thank you in advance for your time!

Further information and contact details:

Researcher's name: Anastasia Tsipa
Researcher's email: ps11ait@leeds.ac.uk

Supervisors' names: Professor Daryl O'Connor, Professor Mark Conner
Supervisors' emails: d.b.o'connor@leeds.ac.uk, m.t.conner@leeds.ac.uk

Appendix 4.2. Participant Consent Form

A) Online Consent Form

Title of Study: Psychosocial determinants of bowel cancer screening
Ethical approval reference number: 17-0123
Ethical approval date: 10-04-2017
Researcher's name: Anastasia Tsipa
Researcher's email: ps11ait@leeds.ac.uk
Researcher's work phone number: 07514 755392

Supervisors' names: Professor Daryl O'Connor, Professor Mark Conner
Supervisors' emails: d.b.o'connor@leeds.ac.uk, m.t.conner@leeds.ac.uk
Supervisors' phone numbers: 0113 343 5727, 0113 343 5720

1. I confirm that I have read and understand the information sheet for the above study
2. I understand that my participation is voluntary and that I am free to withdraw the data I have given until 30/07/2017 without providing a reason.
3. I understand that, in the event that I wish to withdraw my data, I will need to provide my unique ID code created at the beginning of the survey.
4. I understand that the data I have given will be kept confidential and only those who are granted permission to access it will be able to do so. I give permission for my data to be used for further analysis, to be stored, and published.
5. I understand that relevant sections of my data collected in the study may be looked at by the research group. I give permission for these individuals to have access to these records and to collect, store, analyse and publish information obtained from my participation in this study. I understand that my personal details will be kept confidential.
6. I agree to take part in the above study.

By clicking 'Submit and continue' you will have agreed to all of the above.

B) Paper-based Participant Consent Form

Title of Study: Psychosocial determinants of bowel cancer screening
Ethical approval reference number: 17-0123
Ethical approval date: 10-04-2017
Researcher's name: Anastasia Tsipa
Researcher's email: ps11ait@leeds.ac.uk
Researcher's phone number: 07514 755392
Supervisors' names: Professor Daryl O'Connor, Professor Mark Conner
Supervisors' emails: d.b.o'connor@leeds.ac.uk, m.t.conner@leeds.ac.uk
Supervisors' phone numbers: 0113 343 5727, 0113 343 5720

The purpose of this form is to make sure that you are happy to take part in the research and know what is involved. If you are happy to sign this sheet, please confirm each statement by putting your initials next to each sentence.

1. I confirm that I have read and understood the information sheet for the above study _____

2. I understand that my participation is voluntary and that I am free to withdraw the data I have given until 30/07/2017 without providing a reason. _____

3. I understand that, in the event that I wish to withdraw my data, I will need to provide my unique ID code created at the beginning of the survey._____

4. I understand that the data I have given will be kept confidential and only those who are granted permission to access it will be able to do so. I give permission for my data to be used for further analysis, to be stored, and published. _____

5. I understand that relevant sections of my data collected in the study may be looked at by the immediate research group. I give permission for these individuals to have access to these records and to collect, store, analyse and publish information obtained from my participation in this study. I understand that my personal details will be kept anonymous and confidential. _____
6. I agree to take part in the above study._____

Participant Signature: _____
Participant Name (please print): _____
Date: _____
Researcher Signature: _____
Researcher Name: _____
Date: _____

Appendix 4.3. Survey Questionnaire

Title of Research: Psychosocial Determinants of Bowel Cancer Screening Uptake

Hello and thank you for taking the time out of your day to complete this survey. This research is subject to ethical guidelines set out by the British Psychological Society and has received ethical approval from the School of Psychology Research Ethics Committee, Faculty of Medicine and Health at the University of Leeds (ref no: 17-0123); date approved: 10/04/2017).

All of the survey questions refer to doing the home stool test that is sent to you by the NHS every 2 years. This screening test requires you to collect tiny stool samples on a special card and then send it through the post to the screening laboratory to be tested. The purpose of this screening test is to pick up early signs of bowel cancer.

INSTRUCTIONS:

1) **Please ensure you have read the information sheet before completing the questionnaire**
2) **Please ensure you have read and completed the consent form**
3) **Please follow the instructions carefully for each question and respond as honestly as possible.**

Thank you.

1. **How old are you? Please write in years.**

   _____

2. **What is your gender?**
   Male
   Female
   Other_____

3. **What is your primary language? (Please select one box only)**
   English
   Punjabi
   Farsi
   Gujarati
   Polish
   Hindustani
   Bengali
   Arabic
   Urdu
   Other _____

4. **Do you live permanently in the UK? (Please select one)**
   Yes
   No

5. **Please write in your postcode: _____**

6. **Are you registered with a GP? (Please select one)**
   Yes
   No
   I would rather not say

7. How would you classify yourself?

White/Caucasian	**Black or Black British**	**Chinese or other ethnic group**
British ☐	Caribbean ☐	Chinese ☐
Irish ☐	African ☐	Other ☐
Other _____	Other _____	Other _____

Mixed	**Asian or Asian British**
White and Black Caribbean ☐	Indian ☐
White and Black African ☐	Pakistani ☐
White and Asian ☐	Bangladeshi ☐
Other _____	Other _____

8. What is the highest level of education you have completed? (Please select one)

GCSE O level or equivalent ☐
GCSE A level or equivalent ☐
Vocational training certificate/diploma ☐
Undergraduate degree ☐
Postgraduate degree ☐
No educational qualification ☐
Other _____

9. Occupation

a) Do you supervise any other employees? **Please ✓one box only.**
Yes ☐
No ☐

b) Which one of the following occupational groups best describes what you do (or did before you retired)? **Please ✓ one box only**

❑ **Unemployed**
❑ **Homemaker**
❑ **Retired**
❑ **Voluntary worker**
❑ **Modern professional occupations**
e.g., teacher, nurse, social worker, welfare officer, police officer
❑ **Clerical & intermediate occupations**
e.g., secretary, personal assistant, clerical worker, office clerk, call centre agent, nursery nurse, nursing auxiliary
❑ **Senior managers or administrators**
Usually responsible for planning, organizing and coordinating work and for finance, e.g. finance manager, chief executive
❑ **Semi-routine manual and service occupations**
e.g., postal worker, machine operative, security guard, caretaker, farm worker, catering assistant, receptionist, sales assistant
❑ **Routine manual and service occupations**
e.g., HGV driver, van driver, cleaner, porter, packer, sewing machinist, messenger, labourer, waiter / waitress, bar staff
❑ **Middle or junior managers**
e.g., office manager, retail manager, bank manager, restaurant manager, warehouse manager, publican

- ❑ **Technical and craft occupations** e.g., motor mechanic, fitter, inspector, plumber, printer, tool maker, electrician, gardener, train driver
- ❑ **Traditional professional occupations** e.g., accountant, solicitor, medical practitioner, scientist, civil / mechanical engineer.

10. What is your marital status? (please ✓ one box only)

Married/civil partnership
Living with your partner but not married
Widowed
In a relationship but not married or living with partner
Single
Separated/Divorced

11. To the best of your knowledge do you have a family history* of bowel cancer?

**Note: This refers to you having a close relative (e.g., parent, sibling) with bowel cancer*

Yes
No

12. Have you received an invitation to participate in bowel cancer screening? (Please select one)

Yes
No
I'm not sure

13. Have you ever used the home screening kit for bowel cancer? (Please select one)

Yes
No
I would rather not say

a) If you responded 'yes' to Question 12, have you ever had a result that was unclear or positive?

Yes, I have had an unclear result
Yes, I have had a positive result
I have had both an unclear and a positive result
Other _____

14. When was the last time you used the home screening kit for bowel cancer? (Please select one)

Within the last 2 years
More than 2 years ago
Not applicable (please provide reason if not applicable: _____)
I would rather not say
Other_____

15. How would you say your health is at the moment?

Very poor
Poor
Fair
Good
Very good

16. How easy do you find it to understand leaflets and letters about your health?

Very easy

Fairly easy
Fairly difficult
Very difficult

17. As far as you are aware, which of the following are symptoms of bowel cancer? Please select all that apply.

1. Blood in the stool
2. Change of bowel habit
3. Diarrhea or constipation
4. Pain in abdomen
5. Pain in back passage
6. Bleeding in back passage
7. Bowel does not empty
8. Unexplained weight loss
9. Tiredness
10. Lump in abdomen

18. As far as you are aware, which of the following are risk factors for bowel cancer? Please select all that apply.

1. Older age
2. Close relative with bowel cancer
3. Drinking alcohol
4. Low physical activity
5. Low intake of fruits or vegetables
6. High intake of fatty food
7. Red and processed meat
8. Overweight
9. Diabetes
10. Bowel disease

19. How many chronic illnesses, if any, do you have at the moment? Examples of chronic illnesses include arthritis, asthma, cancer, diabetes, heart disease, multiple sclerosis etc.

0
1
2
3
4+

20. Please tick the box that best suits your answer. Doing the bowel cancer screening test is…

Useful	☐ ☐ ☐ ☐ ☐ ☐ ☐	Useless
Beneficial	☐ ☐ ☐ ☐ ☐ ☐ ☐	Harmful
Pleasant	☐ ☐ ☐ ☐ ☐ ☐ ☐	Unpleasant
Disgusting	☐ ☐ ☐ ☐ ☐ ☐ ☐	Not disgusting

21. Below is a list of statements relating to bowel cancer and the bowel cancer screening test. Please circle the number describing the extent to which you agree or disagree with each statement.

	Statement	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
1	My chances of getting bowel cancer are great	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	I worry a lot about getting bowel cancer	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	If I had bowel cancer my whole life would change	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	Problems I would experience from bowel cancer would last a long time	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5	Doing the bowel cancer screening test prevents future problems for me	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6	Doing the bowel cancer screening test will give me peace of mind about it	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7	I find it embarrassing to do the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8	I find it disgusting to do the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
9	Doing the bowel cancer screening test is too time-consuming	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10	I find it hard to remember to do the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
11	I find the instructions of the bowel cancer screening test confusing	**1**	**2**	**3**	**4**	**5**	**6**	**7**
12	I find it difficult to collect the stool samples for the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
13	Not having privacy at home makes it difficult for me to do the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14	If I found out I had bowel cancer, the idea of treatment for it scares me	**1**	**2**	**3**	**4**	**5**	**6**	**7**

15	I think it is pointless to do the bowel cancer screening test if I haven't experienced any symptoms	**1**	**2**	**3**	**4**	**5**	**6**	**7**
16	It is pointless to do the bowel cancer screening test because if I had it, it would already be too late for treatment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
17	I don't know much about bowel cancer as a disease	**1**	**2**	**3**	**4**	**5**	**6**	**7**
18	I am confident that I can do the bowel cancer screening test even if I find it difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**
19	I am confident that I can do the bowel cancer screening test even if I don't like doing it	**1**	**2**	**3**	**4**	**5**	**6**	**7**
20	Doing the bowel cancer screening test is up to me	**1**	**2**	**3**	**4**	**5**	**6**	**7**
21	Doing the bowel cancer screening test is in my control	**1**	**2**	**3**	**4**	**5**	**6**	**7**
22	Doing the bowel cancer screening test would help keep me healthy for my loved ones	**1**	**2**	**3**	**4**	**5**	**6**	**7**
23	Doing the bowel cancer screening test would help prevent me from needing painful treatment	**1**	**2**	**3**	**4**	**5**	**6**	**7**
24	Doing the bowel cancer screening tests does not guarantee I won't get bowel cancer in the future	**1**	**2**	**3**	**4**	**5**	**6**	**7**
25	People who are important to me want me to do the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
26	People who are important to me have done the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
27	I intend to do the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**
28	I expect to do the bowel cancer screening test	**1**	**2**	**3**	**4**	**5**	**6**	**7**

29	Using the bowel cancer screening kit will help detect problems so they can be treated earlier	**1**	**2**	**3**	**4**	**5**	**6**	**7**
30	I would be more likely to do the bowel cancer screening test if I had practical support from others	**1**	**2**	**3**	**4**	**5**	**6**	**7**
31	I would be more likely to do the bowel cancer screening test if I had emotional support from others	**1**	**2**	**3**	**4**	**5**	**6**	**7**
32	I feel confident in understanding written health information	**1**	**2**	**3**	**4**	**5**	**6**	**7**
33	If you don't have your health you don't have anything	**1**	**2**	**3**	**4**	**5**	**6**	**7**
34	There are many things I care more about than my health	**1**	**2**	**3**	**4**	**5**	**6**	**7**
35	Good health is only of minor importance in a happy life	**1**	**2**	**3**	**4**	**5**	**6**	**7**
36	There is nothing more important than good health	**1**	**2**	**3**	**4**	**5**	**6**	**7**
37	I would do the bowel cancer screening test, if I only had to collect one stool sample instead of three samples on three different days	**1**	**2**	**3**	**4**	**5**	**6**	**7**
38	I would not find it embarrassing to collect one stool sample instead of three samples on three different days	**1**	**2**	**3**	**4**	**5**	**6**	**7**
39	I see myself as dependable and self-disciplined	**1**	**2**	**3**	**4**	**5**	**6**	**7**
40	I see myself as anxious and easily upset	**1**	**2**	**3**	**4**	**5**	**6**	**7**
41	I see myself as disorganised and careless	**1**	**2**	**3**	**4**	**5**	**6**	**7**
42	I see myself as calm and emotionally stable	**1**	**2**	**3**	**4**	**5**	**6**	**7**